AVIATION

The Oldest American Aeronautical Magazine

AUGUST, 1930

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AVIATION

The Oldest American Aeronautical Magazine

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Soucek  and "Wasp"

break world's altitude record

Lieutenant Apollo Soucek, U S N, and the "Wasp" powered Wright Apache in which he established a new world's altitude record of 43,166 feet Photos courtesy of U S Navy Recruiting Bureau, N Y

On June 4 Lieutenant Apollo Soucek, U S N, established a new world's altitude record of 43,166 feet with a Pratt & Whitney "Wasp" engine In climbing his Navy Wright Apache plane to the highest altitude ever recorded, Lieutenant Soucek exceeded the former record by 1,044 feet The confirmation of this record by the National Aeronautic Association is a scientific tribute to the combination of the skill of a remarkable pilot and the exceptional performance of the "Wasp" engine

Soucek and the "Wasp" engine again hold world's altitude records for both seaplanes and landplanes Pratt & Whitney engines hold more than half of the heavier than-air world's records established in the United States and three times as many as are held by any other American aeronautical engine

In commercial flying, as in military work you'll find engines bearing the famous "Flying Eagle" seal meeting exacting demands for dependable flying power Approximately 90% of the regularly scheduled air transport lines of the country use "Wasp" and "Hornet" engines

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SPORT . . . BUSINESS . . . AIRMAIL

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* * *

Roomy three place plane (pilot and 2 passengers) Forward cockpit equipped with Dual Controls Full complement of instruments Ample baggage space Top speed 145 m p h., cruising speed 120 m p h Wright Whirlwind J 6 225 h p. engine Price fly-away factory $8000,

Thus Pitcairn offers you utter dependability . . the result of untiring study, absolute precision in manufacture, amazing stability in flying, finely balanced quality The Pitcairn Mailwing —with its millions of miles of night flying on 12 air mail routes — is in itself an aerial laboratory which each day proves how completely it is deserving of your confidence One glance at the ship itself reveals its beauty, and a trial flight will let you personally experience the keen pleasure of that sure and effortless flight so characteristic of the Pitcairn

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PITCAIRN FIELD, WILLOW GROVE, PA.

AVIATION

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The Oldest American Aeronautical Magazine

EDWARD P. WARNER, *Editor*

Volume 29 . . . ***August, 1930*** . . . Number 2

MASS PRODUCTION, BUT NOT MASS DISTRIBUTION

THE airplane industry, among the other ailments with which it has been beset, has stood in danger of a bad case of inflated ideas. With eyes fixed on Ford, Chrysler, and General Motors we have been thinking of production in terms of thousands of units, and thinking of sales the same way. It is a fundamental fallacy. Airplanes and automobiles are alike in this,—that whether you build a dozen a year or a thousand a day, you sell them one by one.

There are occasional exceptions. A builder of automobiles may dispose of fifty vehicles to a telephone company, or of more than that to provision a truck fleet. An airplane constructor may find, in an oil company or in an air transport line or taxi service, a single ultimate consumer for half a dozen machines or more but those are the exceptions. The great body of sales are made singly.

Sales to distributors don't count. One of the fundamental factors in the dilemma in which both the airplane and the automobile industry found themselves last year, and which hit the manufacturers of airplanes with special force, was the over-selling of the distributor. To put a lot of equipment into the hands of a middleman is not a solution of a distribution problem but merely its temporary evasion. The longer it remains in the distributor's hangar, the more of a vexation it becomes. No airplane is really sold until it has passed into the control of someone who is making regular use of it, not merely keeping it as a museum piece or as a non-liquid asset on his books.

All these observations are so obvious that they ought to be trite, but failure to appreciate their force is the fundamental weakness in airplane salesmanship. It is responsible for the scorn with which inquiries at shows or in showrooms are often met. It can be blamed for the slipshod and inattentive service that private owners sometimes receive from the dealers from whom they made their purchases. What every airplane salesman needs to learn by heart, and to repeat to himself on arising each morning, is that the individual prospect is the most important factor in the airplane business. So far as the salesman is concerned, the customer is king, and if he is wise he will abandon any day dreams of possible ways of selling a score of airplanes and concentrate on finding some individual to whom he can sell a single one.

One sale is a very small unit. It has to be repeated five thousand times to cover last year's commercial production. But it is the only unit. There is no way of getting away from it. There is no way of baling customers up into bundles, or of sorting them out according to pattern and submitting them to a standard treatment. The firms that are doing the best business this year are succeeding because they have no delusions of grandeur. They are making it their business to help the distributor and dealer move the product along. They always have time to dig out individual prospects, study their peculiar circumstances, and treat them as individuals. They are, in short, following good automobile distribution practice, with modifications appropriate to the smaller scale of the airplane business and the larger unit value of the product. The whole industry will have

its best chance of success by following that same line. Airplanes cannot be merchandised by signing up a lot of dealers and telling them to sink or swim. Think less about the volume that has to be attained. Think more about selling individual airplanes, one by one and one after another.

AERIAL YACHTING

FOR the first time in sixteen years, the Great Lakes are to be the scene of an organized seaplane cruise. The experiment was tried once under the auspices of *Aero and Hydro,* America's first aviation weekly. By the standards of the time the event was a distinguished success. Its successor of 1930, to start this month, ought to take a leading place among the events of the year. It brings the flying boat back toward its original ideals, of the days when it flourished simply as an instrument of sport. There probably were more flying boats built and sold to private owners, for purely private use, from 1913 to 1915 than in any year of the last five.

This is not just another tour. It has a distinctive place. Upon the welcome given by the aviation public to the Great Lakes cruise, and to other flying-boat cruises on other waters, a great deal is going to depend.

Air transport is a great and a steadily growing business, but air transport is only a minor hope of the airplane manufacturing industry as now constituted. The airplane builders' brightest prospect is in the sale of airplanes to private owners and to non-aeronautical business, especially to the former for personal travel and for sport. To have any lasting place among private owners, flying must be accepted as inherently enjoyable. Even for travel people will prefer to use the organized air lines, rather than buy their own ship, unless they find flying pleasant for its own sake. There was a time when serious business men scorned the thought of sport. It was unworthy of the attention of hard-headed traders who got down to the shop at seven every morning and stayed until late at night, and who would have died of shame had they been detected wasting time pursuing a small white ball over the greensward or trying to coax another inch of speed out of an over-rigged cockleshell in the endeavor to nose out a rival at the turning buoy. Business knows better now. The desire for a good time is recognized as a worthy one, to which manufacturers and merchants may cater without loss of caste. Sportsmen, not motor bus operators, gave the automobile its start. Aviation's place as a sport must not be relinquished.

A seaplane cruise offers a splendid opportunity of showing just how pleasant amateur pilots have found flying to be. The coast, the lakes, the rivers of the United States were made to order for the purposes of recreation. Every summer scores of young folks go out on cruises with from a dozen to two hundred sail and motor craft, following a fixed itinerary but with the having of a good time as the only real objective. Although privately-owned airplanes have a much larger place in the owners' business life than privately owned sail or motor boats can take, they must show themselves able to compete also as pleasure vehicles. They can do so more readily and more effectively afloat than ashore. The success of such private flying organizations as the Detroit Air Yacht Club, and of such cruises as the one that the club is now promoting, offer test cases for the prosperity of private operation in the near future—which means that they are test cases for the prosperity of a large part of the airplane industry.

THE BOY STOOD ON THE BURNING DECK

DESPITE the heroics of that oft-recited epic, we have a firm conviction that the boy was too scared to run. And so now, while sales lag and some of the aviation industry's units falter, it becomes evident that some of the things most obviously needed are not being done, apparently because our sales and operating organization are too frightened to act.

It becomes evident, similarly, that any further great advances in private plane use must depend upon the development of an adequate ground transport system in order than the plane operator may get to and from the flying field and the downtown office without the irritating and sometimes impossible delays and the often appalling cost of the taxi-cab or privately hired vehicle. It would seem that airport operators must have taken the line "and never the twain shall meet" to apply to the automobile and airplane.

The solution of the problem seems almost too simple for expression. If every airport which boasts one constant attendant would but provide at least two automobiles capable of moving under their own power, and always ready to go, touring pilots would drop in at strange airports with some confidence in their ability to reach a hotel sometime before breakfast the next morning. Pilots would be given unhampered use of these "airport courtesy cars," leaving a valuable airplane as security, and a nominal charge per mile driven would pay the cost of upkeep on the car.

By prominently painting the words "Airport Courtesy Car" on each side of the machine the pilot and his companions could drive up to the entrance of the Ritz-Carlton with every assurance of being received in the manner which their estate in life merits, regardless of the actual physical condition of the machine.

If every established airport would provide two or three such cars for the use of visiting pilots private air travel would double in volume, and the sales of airplanes to private individuals would be on the upgrade at once. No one is going to find much enchantment in the ownership of a plane if it merely gives him a license to be marooned four miles from civilization.

SUPERSTITION IN AIRPLANE DESIGN

WE KNOW a designer, a leader in his profession, who shrivels all low-wing monoplanes with invective and categorically consigns them to purgatory. None of them are any good. None of them ever have been. None of them, so he assures us, ever will be.

We might take that more seriously were we not acquainted with another member of the same profession, of equal eminence, who similarly stretches his vocabulary to its uttermost limits in telling what he thinks about biplanes and about anyone who is foolish enough to use superposed wings. Some designers are prejudiced against duralumin, others against wood, others against steel. The engineer with no antipathies is a very rare bird, but the engineer who lets his antipathies run away with him has equipped himself with an Achilles heel.

National prejudices are as common as personal ones. The British, with a tenacity only recently shaken, have shunned the monoplane. A series of fatal accidents in 1912 cast a blight upon the single-wing machine in the British Isles from which it took sixteen years to recover. In Great Britain, again, the welded steel fuselage and duralumin construction in general, were the subject of unremitting governmental opposition. Germany, in the post-war years, has been almost as indifferent to the biplane as Britain to the monoplane. In America we can claim to have shown a minimum of narrowness of national concept of what an airplane should be, but individual American engineers have often been narrow enough to impose a serious handicap upon themselves and their companies.

> "There are nine and ninety ways of constructing tribal lays,
> And every single one of them is right."

There are often about that many solutions for an airplane design problem, and if they are not all right, at least it often happens that no one is conspicuously wrong. There are a great many different design forms and types and materials of construction. It often happens that all come out at very nearly the same average efficiency. None have any weird and miraculous properties. None are subject to any mysteries of behavior. For a particular purpose, some one type is usually better than another, but freedom of judgment ought to be preserved up to the last possible minute. There is no reason to expect that the optimum material of construction for an airplane to go with Admiral Byrd will also be the ideal for running an air line in Ecuador. The general form and wing arrangement best suited to aerial survey may be totally unfitted for running the night mail or carrying passengers on scenic trips over the Grand Canyon. The designer who insists on fitting the specifications to his ideas rather than his ideas to the specifications, merely because he imagines that some class of aircraft has been visited with a hex or a demoniac possession, is like a man equipping himself with a pair of ankle-irons as a preliminary for running a hurdle race.

EMBARRASSMENT OF RICHES

A MEETING was held not long ago, of a large group of boy model flyers, and they were addressed by a great leader of the aeronautical world. By way of sounding out his audience and determining where their sympathies and interests lay he prefaced his talk with an inquiry. How many of those present, he asked, intended to become airplane pilots? A third of the boys returned an enthusiastic affirmative. By way of further experiment, the question was broadened. How many planned to go into aeronautical work in some form? Almost every hand shot up unhesitatingly to its fullest reach.

Superficially that is very encouraging. From one point of view it is definitely a good sign. There never can be too much real genius in aviation, and the model flyers are going to the right school in which to develop both ideas and craftsmanship, but from another aspect this unanimity of desire to find employment in aviation induces some very sober reflections.

There was once a presidential candidate who hardly got far enough in his party convention for it to be discovered that he was a candidate at all, but of whom it was said that no one had ever had so many supporters in the gallery, and so few on the floor where the votes were cast. The aircraft industry has to face the possibility that it may find the world divided into two categories,

both non-income-producing—the cheering section and the would-be workers There never has been within living memory, nor indeed so far as history records, an employment so romantically attractive as the building and operation of airplanes There never has been one that appealed with such unanimity to the youth of the land Colleges that have started courses in aeronautical engineering have been threatened with difficulty, not in securing a sufficient enrollment in those courses to justify their continuance, but in persuading a reasonable number of students to enroll in anything else In one case that comes to mind, within two years of the inauguration of such a course it had a number of applicants for membership exceeding that of all but one of the five fundamental old-line branches of engineering, mechanical, civil, electrical, chemical, and mining The response has been staggering

As in the colleges, so too in model flying and in the glider movement. Make inquiry of the members of the average glider club, and you will find a goodly proportion perhaps as high as two-thirds although it is difficult to generalize, who openly or covertly aspire to professional connection with aviation Again it is both a good symptom and a bad one. For technical progress some years hence, fine For the present health of the aircraft industry, not by any means so fine.

Unfortunately, there is no way in which the airplane industry can take care of all of those who have been caught up by its allure and who would make the heaviest sacrifices to find for themselves a place within its orbit It cannot even, at the present time, take care of all who have been actively connected with it in responsible positions within the past couple of years Unfortunately, there is no known way in which an industry can be put on a sound economic footing by steady accession to the number of employees or would-be employees without at least corresponding increase in the supply of customers

In short, our problem of personnel versus purchasers is simply another manifestation of the super-man complex The aircraft industry still appears to many people as a remote inner shrine of exciting mysteries The poor fellow who is able to do nothing but write a check for the purchase of the finished product remains outside the charmed circle—but without him there would not be any charmed circle There would not be any industry, and we should all starve to death while telling each other what fine fellows we were and what an exclusive society we maintained

This is no wail of despair, but it is a warning At the same time that we watch our own attitude, let us watch the audience that we face Let us break away from the idea so far as we have entertained it, that the primary function of glider clubs and model flying competitions is to indoctrinate future airplane mechanics and aeronautical engineers with the principles of design and construction Regarding the matter quite cold-bloodedly, one glider club of which the membership is made up of conceivably potential purchasers of powered airplanes is worth as much to the airplane industry as twenty clubs in which active participation is confined to individuals unhappily debarred, for economic or other reasons, from any reasonable prospect of becoming airplane owners or users at any time in a reasonably predictable future

In throwing emphasis on the possible buyer, the man who may be able to put something into aviation financially, rather than upon the fellow who with the most laudable motives in the world wants to put services in and take money out, there is nothing snobbish There is only plain commonsense Our most serious need at this moment is not for expansion of the industry, nor for a general effort to increase the industry's personnel We want markets In a general banding together, in an effort to concentrate the various forms of public interest in aviation upon the production of markets, is our best hope

RETIRE THE WIND SOCK ON A PENSION!

OUR aboriginal predecessors in the land knew countless things which we of a brighter day are finding it necessary to re-learn Not for nothing did they follow the custom of signaling from tribe to tribe with smoke columns, for smoke is one of the most visible of all physical manifestations Ten thousand years ago one puff of smoke on a hill top was more plainly visible and carried more meaning to the signalee than a thousand signalers waving palm fronds madly aloft could ever have been And so we are forced to wonder why the same puff of smoke today, in the center of an open landing field is not of more value than the grimy wind sock which flirts slyly about the top of an insignificant pole Many hours aloft have educated us to the conclusion that, regardless of weather conditions, smoke is the most perfectly visible thing on the ground A column of smoke emitting from a pot in the center of the landing field and blowing across the field close to the ground not only tells the direction of the wind but also its velocity, more accurately than could any other medium

Most of the airports of central Europe are equipped with smoke projectors, and some of the more progressive ports in this country are so equipped There is no important stumbling-block in the path of equipping all of our active airports with smoke projectors of approved type Even if there were serious difficulties in the way, it would be stultifying to admit that an industry able to produce ships of the air and ports to handle them is incapable of producing smoke when, where, and as wanted

Statistical Data

NEW material further supplementing the statistical issue, AVIATION, March 22, 1930 is given herewith As announced in our April 26 number (which carried the first supplement) such data will appear regularly each month for the use of those who wish to keep the curves and totals up to date Page numbers in the statistical issue are given

EXPORTS

(Page 694-5-6) May export data were published in the July 5 1930 issue, page 30 Cumulative totals for the first five months of this year are

Number of aircraft	135
Value of aircraft	$2,112,064
Number of engines	127
Value of engines	$803,032
Value of parts	$930,130

LICENSING

New pilots licenses issued during July, 1930

Private	608
Industrial	3
Limited Commercial	70
Transport	91
Glider	20

Changes in grade during July 1930

Private to Industrial	4
Private to Limited Commercial	167
Private to Transport	42
Industrial to Limited Commercial	6
Industrial to Transport	3
Limited Commercial to Transport	117

RECORDS

A complete tabulation of new records will be found on page 20 of THE AVIATION NEWS, issue of July 12, 1930

AIR TRANSPORT AND MAIL

(Page 514) Airway and Operation Mileage as of June 30 1930

Miles of mail airways	27,687
Total miles of airways	47,902
Airplanes miles scheduled daily with mails	99,433
Total airplane mileage scheduled daily	163,182

(Page 575-6 7) Cumulative figures for 1930 air mail data to May 31 (five months)

Total miles scheduled	8,724 820
Total miles flown	8 152 595
Lb. mail carried	3 079,079
Amount paid to contractors	$5 810 973
Average weight per scheduled trip. lb.	265.1
Average compensation per mile flown	$0 640
Average compensation per lb carried	$1.901

(Page 576) Contract air mail regularity (Percentage of mileage flown of mileage scheduled)

May 1930	96 2%

(Page 578) Percentage of Total Route mileage on which mail is carried

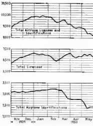
June 30, 1930	57 7%

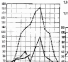
AIRPORTS

(Page 582) Airport statement as of June 1 1930

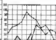
Municipal airports	480
Commercial airports	640
Intermediate fields	305
Auxiliary fields	290
Government fields	81
Total number of airports	1,021

Owing to a change in the method of preparing statistics and to the effect of the inclusion of applications for "Changes of Ownership" in the Department of Commerce license and identification data, it has been desirable to change the basis of plotting the curve on page 600 of the March 22 issue. The curve is modified from January 1 of this year. Prior to that date the figures remain as previously given in our statistical issue but henceforth the average number of licenses and identifications granted each week instead of numbers applied for will be the basis of tabulation





Licensing of Aircraft



Identification of Aircraft

Above: Valid licenses and identifications in force week by week (not including gliders) At left: Average numbers of licenses and identifications applied for or (in 1930) granted in each week 1928 is indicated by a dot-and-dash line 1929, by a dash and 1930 a solid line

THE most striking feature of these curves is the remarkably close parallelism between 1928 and 1930, both on licenses and identifications For each of the last three months licenses have run between 55 and 58 per cent of the 1929 figures The license figures here plotted include restricted and experimental as well as commercial licenses and include also changes that have previously been identified and have subsequently changed over to the licensed class The proportion of American airplanes that are licensed, which had never reached 70 per cent up to the beginning of the year has now reached 73.7 per cent It is somewhat disconcerting to find that the total number of airplanes authorized to operate in the United States reached a maximum in mid January and then declined almost steadily for five months It is now eight per cent below the peak

GOVERNMENTS AND AIRPLANES . . . REGULATION AND CONTROL

By E. P. Warner
Editor of AVIATION

All governments regulate aviation, but no two of them go about it in exactly the same way. Industries watch each other's experiences, and so do governments. American practices are here cast into relief against the diversified background of European regulations.

INTERNATIONAL trade in aircraft is subject to all the difficulties that attend upon the exporting of other commodities If you would sell planes abroad, you must prepare to meet national prejudice, to meet tariff barriers and cunningly drawn discriminatory tariff regulations, and to encounter difficulties of language and of ideas about the proper length of credit and a multitude of other perplexities Those things are all in the day's work for the exporter, and by solving such problems he earns his keep, but in selling airplanes there is another special perplexity, one of which the ordinary export house has little experience and with which it is ill prepared to deal,—governmental regulation.

Practically every independent state in the world now has some sort of an air navigation act, corresponding to our own Air Commerce Act, assuming the national government's authority to control the operations of aircraft and to license the machines and their operators All of the countries that have important aircraft industries of their own, and an increasing proportion even among those that do not, have drawn up more or less elaborate codes of control. They all provide, in the presumed interest of public safety, for a certain measure of supervision over the design and characteristics of airplanes They all provide for some sort of inspection, during construction or periodically during the life of the airplane or both Wide are the variations, however, in the detail of approach to the subject and in the amount and kind of regulation. If an American factory would ship planes to European countries to sell in competition with the native product, obviously its officials must be informed upon the kind of regulation that the native product undergoes There must be a certain equivalence of value of the rules, even though no identity in form, if international trade in aircraft is to be freely pursued. No government will allow the importation in quantity of machines which it suspects to have been constructed under a régime materially less severe or thorough than that which it imposes on its own citizens

Shipments of American aircraft to Europe are a rare and special case, but shipments to Canada and the other British Dominions, to Latin America, and to Asia are becoming very common In most cases, foreign competition has to be met in seeking such foreign orders The nature of the competition from European aircraft in New Zealand, in Chile or in China obviously depends upon the kind of rules under which their designers are accustomed to working

The regulatory methods of European countries are of much more than academic interest to the American constructor There is another reason why it would be so even though the American were quite uninterested in export rade Governments learn from each other In the long run, general trends in governmental policies are likely to become world-wide, especially in respect of the control of products so essentially international in their operations as aircraft or ships The course of European policy will in the long run have its influence in the United States, and to know something of the experience of the British Empire, France, Germany and other countries is to be possessed of a powerful aid in foreseeing possible future events in America

American and European Contrasts

OF COURSE, certain differences in governmental action correspond to real and lasting differences in position At the present time, the American situation, with respect to regulations, is unique in three particulars One is inherent in the physical circumstances of the country and is permanent, a second, economic and psychological in its background, may or may not endure; the third, a matter of governmental determination, lies within the province of Congress and the Department of Commerce to change if and when they find change desirable

Overshadowing every other fact and creating for the Department of Commerce a unique problem, a problem of unparalleled magnitude, is the geographical extent of the Continental United States. From Washington, regulations must be applied over 3,000,000 square miles of territory. Airplane factories are distributed almost over the entire extent of the country Airplanes are being operated from little villages in the plains or in the desert, as well as from great airports in metropolitan centers, and some Department of Commerce inspector must be responsible for overseeing all of them. Sufficiently complex when only powered airplanes had to be reckoned with, with the coming of the glider the problem has broken the bounds of a thousand airports and has been extended onto every hillside

Contrast the situation in Europe. Secretary Young and his officials may well breathe an envious sigh as they look towards England, where most of the airplane industry is within fifty miles of the national capital and all of it within 250, or towards France, where 90% of the manufacture of aircraft is concentrated within an hour's journey by automobile from the center of Paris and where practically all commercial operation is centered in a dozen or fifteen airports, or even toward Germany, where there is much more diffusion, but still a trivial amount compared with that which the American scene presents

Second of the peculiar features of American aviation is the recent boom There are more companies manufacturing commercial aircraft in the United States than in all the rest of the world together, and the number of new designs offered during 1929 probably exceeding that for any European country four times over, another extraordinary burden to be borne by the Aeronautics Branch.

Charges for Inspection and License

HAVING regard only to the first two factors, the third comes as a surprise The American Government has a larger problem of aircraft regulation than any other in the world, and yet, alone among the governments of the great industrial nations of the world, it does the job entirely free of charge In no other country, so far as I can discover, is the work of supervision of design, licensing, inspection and everything that pertains thereto carried through without the collection of a single fee anywhere along the line. The exact extent to which that kind of exemption is really helpful to the industry may be open to question, but the direct measurement of money directly saved is easy to make The Engineering and Licensing Divisions of the Aeronautics Branch of the Department of Commerce did work for the aircraft industry in 1929 for which in most European countries fees aggregating between $100,000 and $300,000 would have been collected

To find out just how regulations stand and just how policies her and abroad compare, I have recently visited some of the leading European centers and collected data from all the available sources, both from the governments which enforce the regulations and from the industries which submit to them Great Britain, France, Germany and Holland were covered with some thoroughness The trip unfortunately could not be extended to Italy so mention of Italian practices, if made at all, must be of a very general character

The I.C.A.N. and Airworthiness

ALL of the countries covered are alike in keeping design requirements under direct governmental supervision All except Germany, which, like America, has not ratified the International Convention for Air Navigation, work within a general framework laid down by the International Air Navigation Commission For several years that body has been engaged in drafting a skeletonized system of design requirements for airworthiness, upon which each country adhering to the convention will build up its own more detailed requirements The original intent was to provide for only a very modest degree of uniformity of rules, stipulating certain minimums of strength and stability, but the skeleton has grown more and more complex and now goes at length into such minutiae as the method of testing materials to be used in aircraft construction It is an open secret that the representatives of at least one government have become much disconcerted at the elaborateness of the structure that they have been engaged in rearing and that they would welcome an opportunity of indefinitely postponing its application Although of course this annex which is being prepared by the International Commission has a certain influence, it is for the present without binding force, since it is not yet completed and is to be applied only as a whole

American Regulations and French

In no European country is there serious attempt to make so thorough a check on design calculation as is undertaken in the United States

The Department of Commerce undertakes to check completely the stress calculations on a new airplane and also to put it through certain flight trials, not including measurement of performance No European government among those included in the present study goes so far in checking calculations but the French authorities come very near to it, and take an additional step in making static tests on the structure of a large proportion of the new types submitted for consideration, Always, except on the very largest planes, the static test is carried out before the machine goes into regular production The French position is peculiar, however, in that practically every new type whether military or commercial, is built to the order of the government It is the regular practice followed by all constructors except one or two of the larger and wealthier ones who prefer to remain on their own responsibility (notably Farman) to submit a design project to the Section Technique Aerienne, a branch of the French Air Ministry and secure its approval and an order for a "prototype" Government officials then watch over the design and construction with the same zealous care that characterizes the supervision of newly-ordered military aircraft in all countries and indeed the same organization supervises military and commercial design.

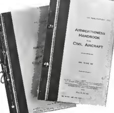
French Methods

The only official information given to an American designer is the familiar Bulletin 7A of the Department of Commerce, a modest pamphlet of 88 small pages, setting forth the specific requirements that an airplane must meet for an approved type certificate, both as to strength, flying qualities and general arrangement It makes no attempt to be a universal text-book of design nor to be a manual of inspection, nor to set forth in detail the specifications of all the materials that are to be used

The French designer, on the other hand, has before him as a guide a formidable volume entitled "Rules for the Construction and the Classification of Aircraft" and comprising just over five hundred pages It goes at length into such matters as the method of determining the chemical composition of steels the permissible design properties for a wide range of alloys, the conditions under which various materials may be fabricated, and an enumeration of the marks of identification to be placed by the inspector Buried in the middle of that impressive tome, in a chapter of thirty-odd pages, are "General rules for the conception of an airplane" which sets forth structural and aerodynamic requirements An American, mindful of troubles recently suffered by some of our own designers looks first for specifications of spinning qualities There is nothing under that head There is no specific requirement of long continued spin and immediate recovery The closest approach is a general requirement that "in all conditions of flight there must be complete maneuverability" and another that "in case, from any cause, the airplane is thrown into an abnormal flight condition, the efficiency of the controls must always be sufficient to permit the pilot to recover". Those provisions may be interpreted to mean much or little, and leave a vast range of discretion to the inspector

In spite of the vast dimensions of the French rulebook specifications for stress analyses are less exhaustive than our own. Like all other governments except that of the United States, the French authorities divide airplanes into several classes, grouped by anticipated violence of maneuver In France and Holland there are three such categories, in Germany five, in England two

Taken as a whole, the French rules for determining adequacy of strength are much less detailed and logical than the American ones, but the French Section Technique has the advantage of dealing primarily with a small number of factories around Paris, with engineers whose qualifications are well known and who, in turn, are well acquainted with the practices of the government departments



The British Designer's Guide-books

The French book of rules for construction and design, although the design requirements are enforced by government officials, bears the name of the Bureau Veritas, the French marine classification society corresponding to Lloyds' in England and to the American Bureau of Shipping here Thereby hangs a tale of a general European tendency, of which more will be seen in other countries.

Germany, and Regulation by a Laboratory

The German government offers no such elaborate volume to the designer's bookshelves, nor does the German government mingle commercial and military design In Germany there is no military aviation, and the control of design is exerted entirely through the Deutsche Versuchsanstalt fur Luftfahrt, or German Aircraft Laboratory, in Adlershof, just outside of Berlin The situation is as though all of the functions of the engineering section of the Department of Commerce were to be transferred to the National Advisory Committee for Aeronautics Under the superintendence of Dr Wilhelm Hoff, Director of the Adlershof Laboratory, there is prepared an unimpressive little collection of mimeographed sheets clipped together within pasteboard covers, which includes the complete German design specification for structural qualities It supplements a clothbound book, of handy pocket dimensions and 130 pages, which offers a profusion of information for the constructor and inspector, as well as general design stipulations on such matters as fire prevention and emergency cabin exits and on certain flying qualities This "Bauvorschriften fur Flugzeuge" prescribes that for "acrobatic" airplanes it shall be possible to spin five turns with immediate recovery and that the spin must never flatten up to less than 45 degrees with the horizontal

If the French specifications are much plainer than the American ones, the German requirements upon the other hand are much more elaborate and mathematical The classification, both of types of airplanes and of types of loading, is minute and most of the load specifications are involved in formulas, sometimes of a very elaborate order

Machines fall into five groups, varying from those which are to be flown only very carefully up to the fifth class which covers the most violent acrobatics and they are further classified as experimental, passenger-carrying, freight-carrying, and sport, making twenty possible groupings in all Five distinct cases of loading are recognized, high angle of attack, normal gliding flight limiting dive, normal inverted flight, and stalled inverted flight, and the German engineer is so familiar with the standard designation attached to each that they are habitually referred to merely as Case A, Case B, and so on without further description

The Deutsche Versuchsanstalt makes no attempt to check stress calculation in absolute detail Checks are made at numerous selected points and a general study indicates whether or not the original analysis was made in competent fashion The designer works under the watchful eye of the official laboratory, has its co-operation in settling doubtful points and in applying the regulations, but he is left largely upon his own responsibility for the accuracy of the work

German landing load factors are proportional to the square of landing speed To determine those factors and for other reasons it is the regular practice to make very careful measurements of true landing speed on new types of airplane A photographic method is used for determining the actual velocity at contact with the ground All machines are brought to Adlershof for test whenever possible

German Air Council and Regulation Making

The Department of Commerce rules are the subject of periodic discussions at the meetings of the Aeronautics Branch officials with the Chamber of Commerce There is nothing exactly like that in any European country, and in France there is no regular channel through which the industry makes its comments and objections, but the German government has gone farther than the American in taking the industry into partnership

Not only are the rules submitted to the industry for comment They are initially promulgated by a committee on which the industry has a place The German Aircraft Council is the source of their issue, and the Aircraft Council is made up of twenty members Three represent the Federal government, two the various German states, five are selected by the Reichsverband, or Aeronautical Chamber of Commerce, three by the Lufthansa and other operators, three by a national engineering society, one by insurance interests, one by a pilots' association, and two by other groups

The German constructor pays for the examination of his machine for an Approved Type Certificate what the work actually costs the government There is no fixed fee, but in practice the charges range from about $200 up For an eight-passenger transport monoplane the fee was $400 For a flying boat of twenty tons gross weight it was $1 250, and to that there had to be added the traveling expenses of the government officials making the test since seaplanes cannot be flown at Adlershof. The French government, as might be anticipated, since the machines to which it is giving Type tests have commonly become government possessions makes no charge for the examination, but a fee is levied for every commercial plane subsequently inspected during its construction and approved for license

Great Britain and the "Approved List"

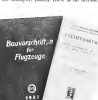
The British practice while on the whole more like the American than any that will be found in other European countries is unique in the method of classifying constructors and of levying fees For checking the design and for type testing charges are made on a fixed scale ranging from $300 for a light plane up to $750 for a three engined transport Those fees, however, are cut in half for firms that have found their way onto the Air Ministry's "approved list", a purely British institution The Airworthiness Section of the Air Ministry over which Mr H B Howard presides, declares that certain firms have been found so competent and reliable that they no longer require detailed supervision Instead of checking them at every step, the government cooperates with them, an engineering representative being detailed to the constructor's plant, much as in Germany, to discuss new problems as they arise and to keep his eye in a general way on what is being done by engineering and design departments The less fortunate manufacturers off the approved list undergo a more careful and continuous surveillance, at greater expense to themselves and with the possibility of greater delay In practice the approved list coincides very nearly with the membership of the Society of British Aircraft Constructors, or in other words with the list of old-established firms engaged largely in military work Although there is an occasional complaint among newer constructors about the difficulty of entering the charmed circle, the system on the whole works out very satisfactorily In America, the making of any such arbitrary distinction would have great potentialities of attempted political pressure on behalf of those who might fail of selection and appeal to their congressmen The Air Commerce Act specifically provides, to be sure, that the Secretary of Commerce may accept the judgment and the report of manufacturers' personnel who in his opinion are qualified in lieu of having complete check and complete inspection by his own staff, but that provision has never been used, and certainly there has never been any idea of grouping manufacturing firms in two classes, the more and the less trustworthy In Great Britain, however, no trouble seems to have been experienced

The British government furnishes the designer with two books, sold to all comers at a little less than a dollar a copy Both are in loose-leaf form and subject to frequent addition or correction, a practice which the Department of Commerce might well adopt One is a collection of rules and definite specifications for design, covering both structural requirements and methods of fabrication and of inspection It corresponds to the French volume of constructional rules but has only about one-fifth the bulk The other, the "Handbook of Strength Calculations", is a real textbook on airplane structures, with full instructions for handling all sorts of cases and with innumerable charts for designing

tapered struts, determining the amount of rubber cord needed in a shock absorber, and so on.

The Airworthiness branch is set up at the Royal Aircraft establishment at Farnborough. As in Germany, it functions in the closest liaison with a research laboratory, although Farnborough is somewhat more like Wright Field than like the National Advisory Committee plant. One Wright Field function that it does not possess is that of performance testing, and for flight trials finished British airplanes, whether they be military or commercial, go to the Royal Air Force station at Martlesham Heath.

The trials to be made there are largely at the discretion of the pilot. Although spins are always included except for transport planes, there is no definite stipulation of the length of spin or of the promptness of recovery. About the advisability of mixing military and commercial testing there are many opinions. Government officials maintain that there is no lack of sympathy towards commercial design in the attitude of the military pilots who do the flying, and that there is no appreciable delay in making the tests. Engineers in the industry cite particularly cases where from three to six weeks were required for test flights, and take it for granted that military work was being given the preference.



The German Manual and the Dutch Air Law

British rules for determining strength strike a middle ground between the French and the German requirements. They are more consistent and logical than the American stipulations, especially where the fuselage and tail are concerned, but they are also less specific and less severe. To an American engineer, the Air Ministry's conditions of tail loading appear dangerously light. Instead of arbitrarily specifying a unit load for the horizontal tail surfaces, a figure is determined as the natural outcome of the conditions of flight corresponding to the various cases of wing loading. No allowance is made for violent movements of the elevator in recovering from a dive. European governments in general are given to insisting that an analysis be carried through for an airplane structure as a whole under a set of balanced forces, taking all inertia loads into account, whereas it is a frequent American practice to treat wings, tail, and fuselage quite separately. The American method often simplifies the work enormously, but often it leads to quite fallacious results and impossible loading hypotheses. There is virtue in both systems, and they should be combined to even a larger extent than in the present Air Commerce requirements.

In Great Britain, and also in France, allowance must be made for the case of a broken wire. With any one wire eliminated, the structure must be able to stand at least half the load factor required if it were intact. There is no such specific insistence in the American rules.

The Department of Commerce, however, makes one proviso, little if at all paralleled elsewhere, in calling for an analysis of the fuselage for the nosing-over condition. That is an inclusion of distinct practical importance, and European design might benefit by more generally taking the nose over case into account.

The details of regulation as practiced in Holland are less interesting to Americans than are the methods of the larger European countries, for the Dutch industry is so compact that there can be an almost complete lack of formality with its relations with the government. There are but three airplane factories of any size in the country, and only one really of the first rank, and all of them are within a couple of hours motor drive from the scientific headquarters of Dutch aeronautics, the Rijksstudiedienst voor Luchtvaart. Dr Wolff, director of the Rijksstudiedienst, presides alike over the government wind tunnels in Amsterdam and over all the work of regulation. Fees are charged for examination for an Approved Type Certificate, but they are almost nominal, amounting to only $120 for a typical passenger plane.

In the inspection of planes in the course of construction and the licensing of individual machines, American practice deviates from the universal European rule of keeping that work quite distinct from the checking of new designs. In Great Britain the Aircraft Inspection Department, generally known as the A.I.D., is connected with the Airworthiness section only by the fact that both are in the Air Ministry. In Germany the functions are similarly distinct, and in France even a further step has been taken in turning the work of inspection over bodily to the Bureau Veritas. Inspection fees range from $20 per airplane in Holland and about $30 in Germany for machines of medium size, up to approximately one per cent of the cost of construction in France.

Classification Societies Undertake Regulation

THE COMING of the Bureau Veritas to the work of inspection marks the most striking of present European regulatory tendencies, and the one that should be most closely watched by American engineers. Gradually but unmistakably, private organizations allied with the insurance business are taking over an increasing share of the work heretofore done by the government.

Like other marine classification societies engaged in the inspection of shipping for underwriters the Bureau Veritas is practically a world-wide organization, with correspondents or surveyors in its own pay distributed everywhere. In 1922 the French government became conscious that certain airplanes licensed in France were being operated on lines entirely outside French territory, and were never coming home for inspection. At the request of the technical section of what later became the Air Ministry, the Bureau Veritas undertook in 1924 to make periodic examinations of such planes. A year later the government turned over to the Society, which has a special charter from the State but is a profit-making organization, the over-seeing of all production. At the present time it has ninety aeronautical specialists engaged in the work under the supervision of the well-known authorities Messrs De L'Escaille and Vollmerange. Authorized by the State to charge up to two per cent of the cost of manufacture of the plane as an inspection fee, in practice the Bureau has kept the levies below one per cent.

There is no apparent idea in France that the insurance classification society will eliminate the government from the task of checking designs. In Germany there are plans to go farther along the same line. There is a definite prospect, which seems to be viewed with satisfaction by everyone concerned, that the Germanische Lloyd, which is to Germany what the Bureau Veritas is to France, will simply step in and that the government will step out in the near future. The plan would be that the Lloyd would take over the engineering personnel now employed by the government, would establish offices of its own adjacent to the Adlershof laboratory, and would call on the research personnel of the government establishment for assistance in connection with any wholly novel problems arising and requiring laboratory work for their solution.

In Great Britain as in France, the classification societies are making their first aeronautical inroads on inspection in the field. Both Lloyd's, the most famous of marine insurance bodies, and the British Corporation, a smaller rival, are now authorized to conduct inspection for renewal of licenses. The owner of an aircraft has the option of examination either by the private organization or by the government. An increasing proportion are selecting one of the classification societies with the expectation of saving time and trouble. It seems likely that it will be a long time before the Airworthiness Department gives over its function to any corporation or society, but there is influential opinion in the British industry that would be delighted to see such a change in prospect, not so much because of any specific objection to the way in which the government now performs its functions as because of a general hostility to the spirit of government control.

The Industry's Feelings About Regulation

THAT HOSTILITY, in fact, is rather general through Europe. In every one of the countries visited, although there were frequent expressions of appreciation of the liberality of view displayed by the government officials and of the competence of their work, there was widespread opinion that all aeronautical activities ought to be commercialized as rapidly and as completely as possible. Various reasons are given. Some feel that a commercial society would have a more practical point of view towards practical difficulties, and would be less likely to be hidebound by its own regulations. Some feel that there would be a more rapid turnover of personnel in private employ, with less stagnation and timidity. Some point out the greater flexibility of an organization which can increase its personnel, or modify the scope of its work to meet an emergency need, without waiting for parliamentary approval. One British engineer made the astonishing observation that in export trade a certificate of 100A1 from Lloyd, backed by the wonderful reputation gained by that name in more than a century of maritime activity, would carry more prestige than any form of approval that the government could confer.

On the whole, relations between the industry and the government are apparently as satisfactory in the United States as anywhere in the world, unless in Holland where conditions are very exceptional. On the whole, too, they are improving the world over. Although the industry would generally prefer somewhat less regulation than it gets, and would be glad to see it applied by a commercial organization rather than by government officials, it is becoming acclimated to what exists. It is a matter of considerable surprise to find that government inspection in the factory is rather generally welcomed, and that protests are directed more against supervision over design. Particularly is that true in England, where some of the foremost constructors would be frankly in favor of a complete abandonment of governmental design supervision, with every product allowed to stand on its commercial reputation. Even firms on the approved list protest that the rules are subject to pettifogging interpretations and that every modification in design or in interior arrangement of accommodation means more delay and uncertainty, with resultant loss of markets. Except for the possibility of loss of time in flight testing at Martlesham Heath, there appears to be no more reason for such complaints and fears in Great Britain than in the United States, but they are certainly more frequently heard and from more responsible sources. The most vociferous advocate of eliminating regulation, however, is among the warmest defenders of the inspection department, remarking that he counted its representative in his factory as a consulting engineer obtained at almost no cost.

In Germany, although a few executives bitterly employ such phrases as "In German aviation we must spend more time writing reports than flying," or look enviously to the United States with the observation that "What in America would be a new opportunity for doing business is in Germany a new opportunity for governmental activity," the general situation is excellent. It is agreed that government officials could be very troublesome if they wished, but equally agreed that in general they display exceptional tact and liberality. The qualifications of the Adlershof staff are greatly admired. Major Tetens, who is Germany's Luther Bell, the secretary of the Reichsverband der deutschen Luftfahrtindustrie, is warm in the defense of government policy, although he like others sees much of merit in the prospective domination of the regulatory field by the Germanische Lloyd.

In France protest against the government's course would hardly be expected, for in France a commercial industry as it is understood here is non-existent. There is very little sale of airplanes for private purposes, the transport lines are all well subsidized by the government and their purchases of equipment are under some measure of government control, and all the constructors look to the government as their source of bread and butter. The government pays the piper, the government calls the tune, and its right to do so is generally conceded, but it was a very distinguished French aeronautical engineer, not at present actively engaged in the industry, who sardonically observed that "In France a man is permitted to commit suicide by any method except by aviation. Only when he goes into the air does the government insist that he be safe." The phrase was robbed of some of its grimness by the smile with which it was uttered, but the thought was akin to one that has often been voiced by Mr. Lees and others at meetings of the American industry.

AIRLINE FARES AND PASSENGER TRAFFIC

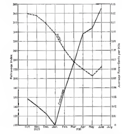
By Eve DeVantery

Statistician, AVIATION

A YEAR ago one of the most serious problems facing the air transport operators was that of inducing the public to fly. There were two views of the public's attitude. One held that the American public were only aviation-conscious in theory, not air-minded in practice. The other declared that people were at least air-minded enough to ride in airplanes when rates for air travel were directly competitive with those by rail.

After the resources of widespread propaganda had been exhausted, with but slight increase in passenger traffic, air line operators turned to rate cutting in the hope that once the average person acquired the habit of flying from city to city, and accustomed to the advantages of air travel, he would remain a steady customer even though the rates on airlines were increased to catch up with operation costs. We have made this survey to find out, if possible, just how far this rate-cutting has taken the air transport business.

The accompanying maps give a clear picture of the predominating rates on October 1, 1929, January 1 and June 1, 1930. During October the prevailing rate throughout the country was between 7.1c and 15c per



How many passengers and at what price?

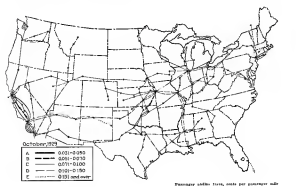
passenger mile. There were two short lines operating at a rate between 5.1c and 7c, and five lines operating at 15.1c per mile or more.

By January 1 the airline rates had begun their descent. The map for that month shows that several lines were operating at between 5.1c and 7c per mile. One line had entered the "A" class by charging less than 5c per mile. Only two of the old lines continued to operate in the "E" class at 15.1c or more per mile. However, two new lines had started operations and were in the "E" class. The balance remained either in "C" or "D" groups operating between 7.1c and 15c per mile.

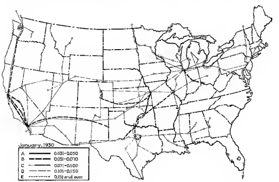
By June the lowest rates were reached. On the map for that month class "B" lines, at from 5.1c to 7c, predominate. While the lines in "A", below 5c a mile, have grown in number they do not hold sway except in the middle west. Only seven lines were left in class "D" and two in class "E", with a number in class "C", which were located almost entirely in the central portion of the country. Thus, except on two small lines, the operators had reduced the fare to less than 15c per mile, and in most instances to less than 10c per mile.

Taking the three maps as a whole and considering them according to geographical divisions, it will be seen that in the New England States the rates have gone from the "E" class to a mixture of the "B" and "D" classes during the last nine months. Rates in the middle east have decreased from the "D" to the "C" class. In the middle west the lines operate at a variety of rates. In October they were in the "D" and "C" class, in June, 1930, in classes "A", "B" or "C". Over the Rocky Mountain district the rates remained in the "D" class during the last three months of 1929 and the first three months of 1930. However, in June the lines split, some remaining in the "D" class, one entering the "C" group and the rest entering the "B" division.

On the Pacific coast the lines operate north and south, rather east and west as is the tendency in the other



Passenger airline fares, cents per passenger mile



The same, January 1

portions of the country. These lines decreased from the "C" class to the "B" class at the end of 1929 The Pacific coast territory had the lowest average rate during the last nine months, with the middle western section close after it and running ahead of it in June The Rocky Mountain district was third, with the eastern portion of the United States next and the New England states running the highest average rate per mile over this period of time

Rates and Patronage

IN THE curves plotted on page 61 we have compared the monthly passenger load with the rates charged per mile These curves were made from the reports of a selected group of companies operating lines in practically every portion of the country, except the extreme south-east and north-west No lines of a pure winter resort type were included The final figures are weighted means, with each line given a weight proportionate to its total traffic These lines cross every type of terrain and operate under all seasonal conditions, and they may be considered as a fair sample of all airlines now in operation The fares plotted are the weighted means of the fares charged by these same companies during each month

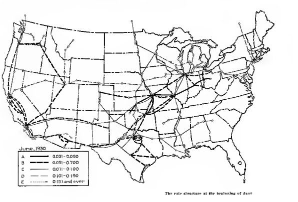
January was chosen as the base line in rating the mean passenger traffic, and was given an index number of 100 The curve shows that passenger traffic for March, 1930, increased 65% over that for November, 1929 In April it had increased 87% over the figures of October, 1929 These months are comparable as regards seasonal influences, January being considered the normal low point in traffic with July and August the high, so a reduction in fare of 46%, together with the gradual acquisition of the riding habit, was responsible for a 75 per cent increase in traffic during about five months

The average fares for January (the lowest point in the passenger curve) had decreased 18% below October fares, and by May had decreased 55%

However in spite of the drop in rates during the last three months of 1929 passenger traffic did not pick up Rather it kept going down The decrease in rates had not as yet reached the knowledge of a great part of the traveling public, and the effect of fare reduction was not sufficient to overcome seasonal decline After the beginning of this year traffic increased rapidly, the percentage of increase far surpassing the rate of reduction of fares Rates and seasonal influences were working together

Increases in traffic during the latter part of the summer will be largely due to seasonal changes, and a drop may be expected with the beginning of the autumnal season However, air lines have secured many new customers and by the time the summer season is over they should be steady customers The drop in air passenger traffic during the winter season should be small compared with the decrease during the last three months of 1929

Fares are beginning to increase slightly The effect on volume of traffic remains to be seen in detail, but preliminary figures for June, the first month of the up-trend with average rates 20% higher than the average for May, give no reason to expect any alarming slump in the number of passengers



The rate structure at the beginning of June

WHERE STANDS THE GLIDER?

By Charles H. Gale

Assistant Editor of AVIATION

The glider was the stepping stone to the powered plane. Are we stepping back again? Then why all this recent glider activity? Is it just a momentary fad, or may we look for additional aid to powered plane development? ¶ This article is the result of a survey conducted to answer such questions, and determine the glider's present place in the world of aeronautics.

THE GLIDER gave birth to the powered airplane, and then retired into comparative obscurity while the latter took the aeronautical limelight Since the war the glider has made a strong come-back in Germany, and in the last 24 months it has enjoyed a rising tide of popularity in the United States and other countries It has won a conspicuous place, for the time being at least and perhaps permanently, although along widely different lines from those of the years before the airplane had been evolved

Gliding was the first successful heavier-than-air activity It was the laboratory instrument by which enough was learned of aerodynamics and aerology to make possible the first sustained heavier-than-air flight The Wright brothers, indeed, made a direct step from gliding to that first airplane flight by the installation of a suitable engine in what primarily was an advanced glider for those days

By its very nature gliding is an activity for a group and in this country we find the group taking the form of a non-profit-making, sporting organization of the club type The clubs far outnumber other organizations, individuals and schools in the promotion of actual gliding, and they furnish the best reflection of the present status of this department of aviation

There were 193 gliding clubs included in our survey Of these, 66 are members of the National Glider Association, the only national body concerned specifically with promotion of the movement All other associations are local, the most prominent of these being the Glider Section of the Southern California Chapter of the National Aeronautic Association

These 193 clubs own and operate 205 gliders Because of the failure of many groups to report on certain items a discrepancy exists in some of the totals presented For instance breaking down the glider total into those bought from manufacturers and those built by the clubs, there are 112 of the former and 60 of the latter, only 172 of the 205 accounted for

On 28 clubs we have no information except that they exist, and we shall omit those 28 from the figures given hereafter Eliminating them, we have 165 clubs, 177 gliders, 94 of which were bought and 50 of which were built by the units themselves There are 3,812 members of these clubs, and 1,302 of them (34 per cent) have made solo flights These pilots are using 122 primary gliders, thirteen secondaries and about six soarers.

The chief questions today are: Has the interest in gliding been sustained and has the sport measured up to expectations as a sport and/or training medium? Seventy-eight clubs report that interest is being maintained or is increasing Two report it as intense while five report indifference and eleven say that interest has fallen off

It should be borne in mind that but 96 of the 165 clubs committed themselves on this matter of interest It would appear that in many cases there is a period of readjustment after the first burst of enthusiasm and after the first stages of actual gliding experience Then, too, clubs which have passed out of existence do not appear in the record to add their weight of discouragement and there is no way of measuring how many of these there may have been in recent months

This leads to the interesting observation that of 110 clubs on which information could be secured a total of 56 stated they had been active not more than three months This represents slightly more than 50 per cent as being merely babes in the woods, as far as the glider is concerned There are 23 which have been active for between three and six months, there are nineteen which have been active between six months and a year and but a dozen with an experience longer than that Gliding is still in its very early stages in this country

It is increasingly obvious that it is too early to draw hard and fast conclusions as to just what should be done

with it or what it is likely to do for itself in the forthcoming months. The aeronautical world should not judge too harshly or too quickly, therefore, nor apply to gliding an over optimism which has already proved embarrassing in some other departments.

Sectional Progress Compared

A COMPARISON of the degree of progress made in five geographical divisions of the country shows just what might be expected—that the most active and the oldest devotees of gliding are to be found in the central division which comprises Ohio and Michigan, and the Western section which includes California. There are more clubs in either of these two regions than in the other three together and they are the most firmly entrenched.

For instance, in the western division—made up of the Pacific Coast states and Utah, Colorado, Nevada, Arizona, New Mexico, Montana and Oklahoma—there are 58 clubs reporting. They own 73 gliders, 30 of which were bought and 25 home-built. These last two figures are worthy of more than passing notice for proportionately fewer machines were bought and more were built than in any other section. These clubs have 1,193 members of whom 391, or 31 per cent, are able to solo. They use 49 primary gliders, six secondaries and four soarers. Two of the clubs have been disappointed with glidings as a sport and another has decided its merits as a training medium had been exaggerated. All other clubs declared the interest was holding up or improving and several reported considerable enthusiasm. Ten clubs have two gliders each in operation, three clubs have three gliders each, one has four, another five and the San Diego Glider Squadron has eight.

The general practice around Los Angeles is to launch by shock cord. Airplane launching and towing is, of course, ruled out except by special permission of the Aeronautics Branch and even auto towing is frowned upon at Los Angeles except under expert instruction. However, the automobile is used for stretching the cord in shock cord launching from a hillside. There is a definite tendency toward the secondary and soaring types and along with that seems to go a tendency for the clubs to break up into groups of three or four persons after the larger group has received its training.

San Diego is another busy gliding center. Eight clubs were heard from there but it is known that at least eleven primary gliders, six secondary and eight sailplanes are being built under unreported auspices. One San Diego group makes a practice of going to the Chula Vista Airport, about six miles from the city, to practice gliding between 4 and 8 a.m. on school-day mornings. A high school club of 24 members has built twelve gliders under school supervision within the last school year, and declares that one glider cost $14 in actual cash, two others $34 and $35 respectively.

Oregon appears to have only one club but that is an outstanding one. It has its own airport, has developed its own catapult launching device, has been organized since October, 1928, and has 25 members, all of whom solo. The members state that gliding has surpassed expectations both as a sport and as a training medium.

In the Central division—comprising Ohio, Illinois, Michigan, Indiana, Nebraska, Kansas, Missouri and Iowa—the reports give a total of 57 glider clubs, owning 54 gliders. Of these, 31 were bought and eleven were built. Although this division boasts 1,676 glider club members as compared with the 1,193 of the western division, the ratio between total members and members who have soloed remains the same—31 per cent. There are 519 who have soloed. The clubs are using 39 primaries, four secondaries and two soarers.

The majority report interest as holding its own or definitely increasing, one is very enthusiastic, four are losing interest and one is indifferent. Of the 27 that commented on whether or not gliding has measured up to expectations as a sport, 21 were satisfied that it has, two stated that it has surpassed expectations, two others declared it had not measured up and two questioned its value. Only sixteen commented on its value as a training medium and of these, eleven consider it excellent, two state it has no such value and two question it. Only three clubs have two gliders each, another club has four and another six.

The Wright brothers gliding at Kitty Hawk

Akron and Detroit Busy Centers

WHAT Southern California is to the Western division, Akron and Detroit, supplemented by other centers in Michigan, are to the Central area. There are at least eight clubs in Akron and among them is the oldest of those reported in this survey. This is the Akron Glider Club organized about three years ago and actively gliding for two years. Its membership includes a number of men who have been among the most prominent in the growth of gliding movement in this country and Germany, the cradle of modern gliding. Among these are Dr. Wolfgang Klemperer and others attached to the Goodyear-Zeppelin plant. Two other Akron groups have been in operation about two years. Detroit is the home of the N.G.A. and there have been many glider groups operating in that city for a long time. There are more than a dozen in operation now and at least a third of them are about a year old.

There is and has been a small amount of gliding activity around Chicago but to date gliding is in a very preliminary stage in that area. Among the leaders have been the Joliet Glider Club at Joliet, Ill., and the Windrider Glider Club of Palatine, Ill. The latter has two glider ports from which it operates.

The eastern, southern and north central states have not been as conspicuous in their glider development. Between them they have 60 clubs. There are fewer gliders, however, there being but 50 as compared with the 73 in the West and 54 in the Central sections. The combined membership totals 993.

In the East—comprising Maine, New Hampshire, Vermont, Rhode Island, Massachusetts, Connecticut, New York, Pennsylvania, New Jersey, Maryland, Delaware, and the District of Columbia—there are twenty clubs and seventeen gliders. Ten of these were bought and seven built, the highest build your own ratio of any section. The clubs have a combined membership of 511, of whom 211, or 39 per cent, have soloed. There are eleven primary gliders and three secondaries.

Interest is on the upgrade in eleven clubs while three are indifferent and two are discouraged. Six say gliding meets expectations as a sport and two claim expectations are surpassed. Eight report that it seems to meet expectations as a training medium. There are but three clubs having more than one glider each and these have only two each. Two clubs have been organized more than a year but the majority have been started within the last three months.

The East has felt the German influence especially strongly. The arrival of the German instructors for the Cape Cod glider school in 1928 stimulated interest in the sport and much of the movement in this section since that time, has revolved around that influence. It was even the general rule in New York and New England until quite recently to denote glider types by their German names of Zögling, Prüfling, and Professor, instead of primary, secondary, and soarer. Club groups in Massachusetts, upper New York State and in New Jersey are setting the pace for this section of the country. Doubtless much progress would follow immediately in the wake of the making available of suitable gliding terrain within fairly easy access of the metropolitan areas. Up to the present time, few sites have been available.

The South has been alive to the possibilities of the glider, and eighteen clubs are known to have been organized in that region. Nineteen gliders are being operated, sixteen of which were bought and three built. Total membership is 271 with 34 per cent, or 102, of the members soloing. All the types reported are primaries.

Nine declare interest growing, three say it is dormant and two are discouraged. One feels it does not measure up to expectations either as a sport or a training medium while the rest are satisfied with it in both respects. Fourteen have been in operation less than three and one about seven months.

In the North Central States — comprising North and South Dakota, Wisconsin and Minnesota—there are twelve glider clubs. They own fourteen gliders, of which seven were bought and four were built. The clubs have 161 members, 55 per cent, or 89 of which have soloed. All the gliders are primaries. Interest is being maintained in nine clubs while one disputes the value of gliding as a sport. Two others question it as either a sport or training medium. One is enthusiastic about it as a sport and another as a training activity. The majority have been organized within the last six months.

Two Groups of Manufacturers

GLIDER building in this country started with groups resembling clubs. When something resembling a market developed, a few groups here and there took on the attributes of manufacturing companies. There evolved two groups—one devoted itself entirely to glider manufacturing, usually as the result of previous interest in gliding merely as a sport, and the other was the airplane manufacturer who saw in the glider field an opportunity for his already functioning plant, especially in view of the slackening of aircraft production. For this attempt to develop a glider industry there has been no parallel in any other country. Most manufacturers, like most of the home builders, have been content to show very little originality and to rush into production with a close copy of the German Zögling. As many German authorities agree, the defects of that type are numerous and serious.

On the Pacific Coast there is the Bowlus plant, one of the best known and most active in this country devoted to glider production. On June 21 this company had orders for six weeks' work and between April 15 and that date it had sold and shipped 15 gliders and 25 sailplanes.

Bowlus has discontinued temporarily building the primary glider in favor of the new combination sailplane described in AVIATION for June 30. Production is at the rate of three per week and general activity of the company is on the upgrade.

The Evans Glider Co. in Los Angeles is building a metal frame type of primary glider at the rate of about three per week. The MacGill Glider Co. of San Francisco has built five primaries and two secondaries and has a production rate of two of the former per month. Secondaries are being built only on order.

Among the other companies in the western division is the Alexander concern at Colorado Springs. This company reported early in June that 131 primaries had been shipped from its factory since February 1. The demand for, and inquiries about, primary machines is about ten times that for secondary types and the volume of inquiries is continuing almost the same as earlier in the season, an average of about 30 per day.

In Akron the Baker McMillen Co. is building its

Launching a Bowlus sailplane carrying Colonel Lindbergh

Cadet II closed cockpit model at the rate of about three per week. This was designed by Frank Gross, of Darmstadt connection. Over in Detroit the Detroit Aircraft Corp. recently brought the total number of Gulls it had built to about 150. Before Gliders, Inc., was taken over by D.A.C., it had constructed about ten.

The Waco factory has reported much activity there with inquiries regarding glider running about fifteen per day and shipping being at the rate of about three or four a day.

Leonard Motorless Aircraft Corp. in Michigan has been building machines of the two-place primary type. At least 21 have been identified by the Government. Cessna is still another airplane manufacturer who has gone in for gliders. Production there dropped in June from two per day to about three per week. Mono Aircraft at Moline has produced several machines. The Peel Glider Boat firm at College Point, L. I., has been active in developing water craft.

This does not by any means cover all the individual manufacturers but it serves to indicate what the leaders in the field are experiencing. There are also many individuals or small groups which have been producing machines during a period of unusual demand, such as has existed in certain areas within the last eight or twelve months, but which are not equipped to go into the open market. Many of these units have supplied the local demand but go no further.

Further insight to glider manufacturing is afforded by a tabulation of the identifications granted by the Aeronautics Branch for each make by states. Up to the middle of June the identifications totaled 515 [on July 7 the total had reached 612]. The breakdown of the totals by states is open to some interpretation. For instance the states showing the greatest number of identifications are California with 116, and Colorado with 117. The former figure is not surprising, but the latter is a bit misleading at first sight.

By breaking these state totals down we find that in California 48 of the above 116 are still recorded in the name of the manufacturer and one is still in the hands of a dealer. On the other hand in Colorado 116 of the above mentioned 117 still stand in the name of the manufacturer. In other words, just about all the Alexander Trainers on the Department's books are in the name of the company.

However, a great many of these products are being used outside of Colorado. Twenty-three clubs definitely stated they were using that type. Either identifications have not been transferred to the purchaser and the gliders are being flown contrary to federal regulations or the transfer papers are extremely slow in being cleared. Either of those situations merits immediate correction.

Organized glider schools are rather few and far between. So much of the glider training has been done through the group activity of clubs or by informal groups of interested individuals that the school in general has not figured very prominently. However, glider schools do exist and a few of them have served as focal points in the movement. The most prominent has been the school at Cape Cod, apparently inactive at the time of writing.

There are many flying schools offering courses in airplane operation which have purchased gliders and have gone in for instruction in their operation as a side-line. In many cases these concerns are the local agents for one of the aircraft manufacturers, such as Alexander, Waco and Cessna, and have taken from the factory one or more of these machines to experiment with them as training machines. You will find at almost every large airport at least one glider, usually idle, however.

Powered Glider Looms

THERE is a definite trend toward the powered glider, particularly in the West. This tendency is attributed to the desire to graduate from straight gliding and to satisfy a characteristic American preference to be able to go somewhere with some control of destination and speed of travel. There is a point where the glider seems in certain cases to become boring and the powered machine represents further explorations in that realm of flying which involves major dependence upon aerodynamic efficiency. This is much more fun, many say, than working hard for the sake of making one launching at a time for one pilot at a time and for only a few seconds duration.

A number of types of powered glider are being developed by such concerns as Evans, Bowlus, MacGill, Crawford, Johnson Airplane & Supply Co., and others. Engines range in horsepower from 2 to 25 and more.

There has been little governmental regulation of gliders in this country to date but the Aeronautics Branch, after much consideration of the problem and consultations with leaders in the movement, arranged to license glider pilots effective June 12. Identification of gliders has been carried on for some time. Effective October 1, regulations will go into operation regarding Approved Type Certificates and licenses for gliders.

There are three federal pilot licenses. There is a student permit corresponding to the student pilot license in the airplane field; a non-commercial license for those wishing to indulge only in gliding as a sport, and the commercial license. The non-commercial license involves a test consisting only of three take-offs and landings with moderate turns in either direction. The commercial license involves a physical examination comparable to that now given private airplane pilots, and a flight test which includes moderate turns, a 360-deg. turn and precision landings.

A certain amount of supervision has been carried on by the National Glider Association among its member clubs. This association was organized early in 1928 as the Evans Glider Club and the present name was adopted Jan. 1, 1929. It has sought to promote gliding through the clubs. In the fall of 1929 the association launched a campaign for 1,000,000 glider pilots in five years. Limited financial resources have hampered the organization's work, however, and at the present time it is carrying on only a modest program.

Summary of Glider Club Reports by Geographical Division

Area	No. of Clubs Reporting	No. of Gliders Owned	Number Bought	Number Built	Per Cent Bought	Per Cent Built	No. of Members	No. of Pilots	Per Cent	Primary	Secondary	Soaring
East	20	17	10	7	59	41	511	201	39	11	3	0
South	18	19	16	3	89	11	271	102	34	12	0	6
N. Central	12	14	7	4	50	28	161	89	55	11	0	0
West	58	75	30	25	42	54	1,193	591	51	49	6	4
Central	57	54	31	11	58	20	1,670	519	31	39	4	2
Total	165	177	94	50			3,812	1,302		122	13	8

Distribution of Department of Commerce Identifications
(To June 14, 1930)

	Manufacturer	Dealer	Clubs-Schools	Individuals
Alexander	136	2	2	2
Bowlus Glider	24			1
Bowlus Sailplane	15	1		
Baker-McMillan Cadet	4	1	2	3
Cessna	15	17	21	15
D.A.C.	12	6	9	1
Evans	4		4	1
Leonard	21			
Northrup		1	1	5
Waco	3	36	2	21
All others	26	9	39*	73**
Total	240	73	80	122

* Includes 31 built by clubs and schools

** Includes 64 built by individuals

Note—The distributions given for Alexander and Bowlus obviously are inaccurate because both these types have been fairly widely distributed following the original identification.

The N.G.A. has had its own license plan for glider pilots, and as of June 15 reported 106 pilots of the third class, 33 of the second class and twelve of the first class. There were 63 clubs.

The National Aeronautic Association has fostered gliding in an indirect way, and through its connection with the F.A.I. has charge of gliding records as it does of records in the lighter-than-air and heavier-than-air fields.

The same wave of enthusiasm in gliding has been experienced beyond the borders of the United States. To the north in Canada the flying clubs already functioning under the encouragement of the government have gone in for the activity, using in many cases American products. In Mexico interest is just beginning to express itself in the form of clubs. Mexico City and Monterrey are the two points where appreciable activity has existed.

Germany Leads the World

OF ALL the nations of the world, Germany stands first in glider activity. When the Versailles Treaty forbade the continuance of military flying or the maintenance of an aeronautical reserve, enthusiastic German youth built gliders and turned with them to the Wasserkuppe, in the southwestern part of the country, where experiments had been carried on as early as 1912. It was in Germany that the first notable duration records were set up, and it is from there the most of the inspiration for glider activity and most of the fundamental research on soaring still come. There are today about 900 gliders in Germany, and from four to five thousand pilots. About 400 gliders were built last year and 587 new pilots received the third-class license requiring only a straight glide of thirty seconds' duration. Two hundred and seventy five were promoted to the second class and 71 attained the first class or real soaring certificate. Gliding as a sport is under the general auspices of the Deutschen-Luftfahrt-Verband, the German association of clubs, and both as a sport and as a means of research it is liberally supported by direct government subsidy.

Schools for the training of pilots have been maintained for a number of years by the Rhon-Rossitten Gesellschaft, operating both on the Wasserkuppe and in Rossitten in East Prussia, and by the Grunau School in Silesia. Commercial flying interests in Germany look upon the glider with considerable favor, and try to facilitate the acquisition of glider experience by their pilots.

However, the statement that all German pilots are required to take glider training as a pre-requisite for their general licenses, often and positively made in the United States during the past couple of years, is absolutely without foundation in fact. So are many other exaggerated declarations about the magnitude of German gliding activity.

Post-war gliding in Great Britain, as in other countries, grew out of interest in German achievements. A meet was held in 1922 on Itford Hill in the south of England, and as in the contest held a few weeks earlier in France, but in decided contrast to German tendencies, a large proportion of the entries were made by leading airplane manufacturers. In Germany the lead has always been taken by clubs formed in technical schools and by such organizations as the Rhon-Rossitten-Gesellschaft, which is more concerned with research than with commercial development and which itself is closely allied with the technical high school at Darmstadt.

British interest faded swiftly away to nothing after the 1922 meet, and was converted into a temporary enthusiasm for light airplanes of extraordinarily low power, similar to the power gliders now attracting so much attention in the United States. They, too, disappeared in due course. This year there has been a gliding revival like that in the United States, but on a far more modest scale, and emphasizing gliding rather as a sport on its own account than as a method of training pilots or as a form of first aid to the aircraft industry. The British Gliding Association has been organized with 19 associated clubs. Like many other branches of British aviation it has received the stimulus of a substantial contribution—$5,000—from Lord Wakefield.

The extent to which interest is being displayed in this organization is shown by the fact that its president is the director of civil aviation in the air ministry, Sir Sefton Brancker, and Frederic Handley Page is vice-president. The Association will establish and supervise its own airworthiness regulations. The Royal Aero Club has given it official recognition and has delegated to the Association the control of gliding as a sport, including competitions.

The British clubs are drawing heavily on German gliding experience, of course, but it is interesting to note that the London Gliding Club has built a glider from the plans of the National Glider Association of this country. Competitions are being arranged between teams representing various clubs.

French Gliding Encouraged

FRENCH experience has coincided pretty much with that of Great Britain. Twenty-five and more years ago there were many glider flights by such pioneers as Captain Ferber, the Voisin brothers and Louis Bleriot. The latter, by the way, is credited with having made towed flights behind a boat on Lake Enghein, near Paris, with a float biplane glider. There was a shortlived revival in 1922, as there was in England, but as in the case of the latter increasing interest in the light airplane spelled the doom of gliding for the time being.

During the lean years Lieut. Joseph Thoret contributed much to keeping interest alive. In addition to extensive glider flights he made a number of notable hops in powered planes with engines stopped and on two occasions

stayed aloft 7 hr. 3 min. and 9 hr. 4 min., respectively, with a Hanriot HD-14 school plane with a dead stick. At another time, using a Hanriot seaplane fitted with pontoons he climbed 1,650 ft. with the engine dead.

In 1928 the University Aeronautical Club was organized for the benefit of students wishing to participate in the sport. The original membership of 30 has grown to 200 and about 1,500 flights have been made. Branches have been established in various schools. The Committee of French Aeronautical Propaganda was impressed by the work of this University club and formed within its own organization what is known as the "Avia." This is supported in part by the French Air Ministry and is a technical bureau as well as a promotional element. It has established complete sets of working drawings of a primary glider and is preparing drawings for two advanced types. Private companies build gliders, also.

Those wishing to learn to glide are encouraged by this body to form a club of about 20 members. A set of drawings is furnished for about $8 and on its completion by the group the glider is test-flown by a representative of Avia who also trains an airplane pilot of the group to act as an instructor.

Avia intends to establish a laboratory for research in aerodynamics and aerology along the lines of the Rhoen Institute. No government regulations have been formally established in regard to design, stress analysis, etc., but load factors approximating those in force in Germany are being applied. The official control of gliding is in the hands of the Touring Commission of the Air Ministry and active promotion of the sport is being undertaken. A prize of $800 has been offered for competition at the next glider meet scheduled for the fall.

Hungarian gliding is being led by a group of airplane pilots who received their 1st class licenses at the Rhoen school. Buildings and equipment are being provided at an airport near Budapest and should be completed this year. Between April and November last year three courses were given with about twenty students in each course. During the first course a total of 224 flights were made.

Gliding in Holland has just been started. One club has been organized and other clubs are in prospect. The North Sea coast between The Hague and Helder is considered the most suitable gliding ground. The club has selected a location about 20 miles from The Hague and erected a hangar. About 250 flights had been made up to June 15.

Gulls "on the line" at the Lake Orion (Mich.) gliding grounds

Gliding Holds Promise

APPARENTLY gliding as a sport has proven to be satisfactory although the fact that a glider has to be retrieved from the bottom of a slope or from the point of landing on a level field for the next take-off takes away much enthusiasm. Various methods of eliminating or lessening this drudgery have been tried with some success. Among these are the various methods of towing by auto, along the ground or on a carriee.

This feature, coupled with the desire to have more control over the flight of the glider, prolong its time in the air and enable reaching predetermined points as well as return to the take-off spot, contribute to the tendency toward the powered glider. It is too early as yet to venture a prophesy in this regard except to recognize that much interest is being shown.

The training features of gliding are being questioned more and more. A number of groups reported enthusiasm but the general opinion is that, specifically as a trainer for the future airplane pilot, not enough experience is gained to make it worthwhile. However, the experience gained while operating the machine for sport, especially while one's finances are limited, is valuable.

Much emphasis has been given to the safety aspects of gliding. During the last twelve and eighteen months when gliding was assuming prominence there were many remarks to the effect that one could not be killed in a glider or they were so fool-proof that practically no introduction to their use was necessary for the embryo pilot. Following a series of bad crashes, a number of them fatal, the opposite cry was heard.

Reviewing these accidents it seems that in almost every case inexperience or over-straining of equipment was responsible. In other words, gliding is safe when reasonable precaution is taken and when craft designed for certain types of gliding are not called upon for other types in which they are subjected to abnormal strains. It was characteristically American that there should be a rush to such events as airplane towing and auto towing.

Neither of these are widely practiced by the Germans, who have experimented with every phase of glider operation over a period of years with only a few fatalities. The American tendency was due largely to lack of natural gliding terrain and a desire to create one's own "hill." There was also the incentive for an additional thrill. As a result of these accidents, a more conservative practice is being followed, with an increase in safety assured.

It is obvious that gliding in this country, as well as every other country except Germany, is still very much in its infancy. Most of the failures to live up to its promises may be attributed to the setting up of exaggerated hopes and to a failure to adapt the activity to the peculiarities involved in each country. The German example must be considered as an evidence of what can be done, although not necessarily an absolute guide.

Where good terrain and the experienced leaders have been available gliding has flourished. Too much weight should not be placed on the fact that the glider as an airport publicity adjunct or a flying school side line has fallen off. Such uses are of doubtful value anyway.

Gliding is in a period of adjustment, experiment and development and the present season is a crucial period in its evolution. Taking everything into consideration its place in the aeronautical picture seems assured although its future form is open to conjecture.

AIR NAVIGATION FACILITIES

By F. C. Hingsburg

Chief Engineer, Airways Division, Department of Commerce

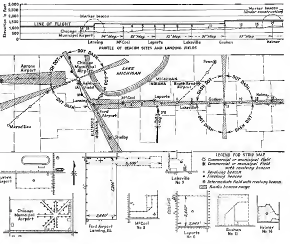
This is the first of a series of articles by Mr. Hingsburg on just what the work of the Airways Division means to the pilot traveling the route. Vaguely, we have all known that a large amount of radio development was being carried on, and that great lengths of airway were being lighted. Few of us have understood in detail exactly what lessons the Department of Commerce was learning and how its knowledge was being applied to particular cases.

THE most complete and highly developed system of air navigation aids in the world has been available to the American flying public for nearly a year on the Chicago-New York Airway. This airway, once termed the "graveyard of the Air Mail," has become the testing ground for the development of systems of lighting, radio and telegraph communication, radio beacon service, and weather reporting. Situated, as it is in the stormy corner of the United States, skirting the misty shores of the Great Lakes, crossing the cloud ridden, inhospitable slopes of the Alleghenies, and terminating on the frequently fog-bound Atlantic Seaboard, it presents every variety of weather and topographic hazard which must be overcome in the maintenance of scheduled air transportation, and is thus an ideal laboratory in which to prove the worth of the various airway aids which have been devised for increasing the safety of flying by day or by night. The map shows the facilities graphically.

In the evolutionary process, the lights and fields came first. This was the first airway to be completely equipped with 24 in. revolving beacons as the standard aid for night flying. These were originally installed by the Post Office Department during the period of Government operation of air mail service, and were taken over by the Commerce Department July 1, 1927. Since that time, the airway has been practically rebuilt, with new steel towers and beacons of improved design; course lights flashing a dot and dash characteristic which will identify the individual beacons have been added, and underground electric circuits with 15 and 25 watt lamps have replaced the old primary cell boundary lights. Many of the intermediate landing fields have been extended, graded, and otherwise improved, while several fields of doubtful value except as crash locations, have been abandoned. A number of beacon sites have been relocated so as to straighten out the airway and to secure better visibility from light to light.

The profile and the accompanying map show the system of placing lights alternately at high and low points which permits light to light visibility under the poorest flying conditions. Establishment of lights at various altitudes reduces the chances of their being obscured in thick weather, for a low ceiling which might cut off view of the higher lights will not affect those at lower levels, and ground fog or mist which blankets those in the valleys will not affect the visibility of beacons located on the higher points of land.

THE STANDARD airways beacon projects a beam of a maximum value of approximately 1,000,000 cp. This beam is elevated so that its center line passes 1000 ft. above the adjacent beacon ten miles distant, and the zone of greatest lighting effectiveness extends from 500 ft. to 1500 ft. above this adjacent beacon, thus providing maximum lighting for the low altitude flying which is frequently necessary in bad weather. The beacons are equipped with 24 in. parabolic mirrors and 1000 watt, 110 volt incandescent lamps mounted in lamp changers which automatically throw a spare lamp bulb into focus and into operation within a fraction of a second after the failure of the first lamp. Revolving at a speed of six revolutions per minute, these beacons throw a powerful flash in the pilots' eyes every 10 sec. Course lights flashed by a mechanism connected with the vertical shaft of the revolving beacon send forth a dot and dash code identifying the particular beacon, which commences two and one-half seconds after the flash from the revolving beacon and ends five seconds later, or two and one-half seconds before the next succeeding main beacon flash. Two course lights are used at each site, pointing directly to the adjacent beacons on either side of the site at which they are located. The course lights are fixed projectors using 110 volt, 500 watt, monoplane filament lamps with cylindro-spherical reflectors and 10 in. and 18 in. doublet semaphore lenses, developing approximately 100,000 beam candle power in the red and green colors used. Green course lights are mounted at inter-

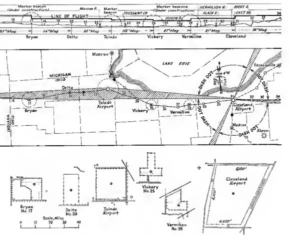


mediate landing fields, and red lenses are used at beacon sites where no landing facilities exist Each beacon and field site is given an official number corresponding to its mileage on the airway A beacon located between 20 and 30 miles along the airway is No 2, one located between 140 and 150 miles is No 14 There are ten course light code signals representing the numbers from zero to nine. Beacons Nos 4, 14, 24, and so on, flash the number four code signal Thus, a pilot who knows which 100 mile section of the airway he is in can always know which beacon he is nearing by observing the dot and dash characteristic of the course light

The intermediate fields are outlined by boundary lighting systems so as to show the landing area to the pilot as he approaches the field Green range lights mark the best approaches and runways Red lights are mounted on all obstructions and red lights in the boundary lighting circuit indicate obstructions and hazardous approaches from the direction marked Internally lighted wind cones are mounted on the beacon tower from a side bracket

A thoroughly modern, fast and efficient weather reporting system has been developed and placed in operation in the Chicago-New York route, using the teletype system of communications The circuit showing the teletype communications between radio stations, principal landing fields and weather reporting stations is illustrated on the map of air navigation facilities Twenty-one telegraph-typewriter stations are connected into the circuit Weather information is collected once each hour from all stations in the circuit, the operators sending their weather reports on the teletype circuit in sequence Complete exchange of weather information over the route of 740 miles in length is accomplished in less than 10 min The weather reports are made available to the air transport operators and others subscribing for receiving telephone typewriters service from the American Telephone and Telegraph Company on the circuit Functionally the weather service is under the Weather Bureau and the communications are handled by the Department of Commerce The Weather Bureau stations at the terminal airports keep the weather maps up to the minute and make the necessary digests and interpretations of weather information These are disseminated and broadcast to airports and pilots in flight

The weather reports are broadcast from the Department of Commerce airways radio stations at Maywood, Ill., Bryan and Cleveland, Ohio Bellefonte, Penna and



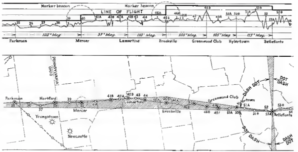
Hadley Field, N Y The radio stations are equipped with 2000 watt radio telephone transmitters for broadcasting the weather reports by voice The airways radio stations are also provided with high frequency radio transmitters for point to point communications and exchange of information in the event that land lines are cut off by storm or other unforeseen conditions

Pilots desiring to be reported throughout the flight over the route may make arrangements with the air port managers at the terminals for this service The departure of the airplane is covered by a "PX" message placed on the teletype and the reporting stations along the route receive a copy of the movement message and knowing the average elapsed time of an airplane in flight from the terminal, will keep a sharp lookout for the passage of the airplane. Upon passing over the reporting station, the airway keeper reports the exact time of the plane passing over which is transmitted on the teletype A written record of the flight of each airplane is thereby established and made available in the event of a delayed schedule or failure to arrive at destination within the usual schedule time

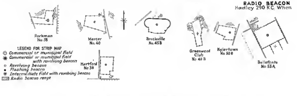
The Chicago-New York Airway has been equipped with radio range beacons marking out a radio channel, as shown on the map of air navigation facilities, which coincides with the lighted route To take advantage of radio guidance, the airplane is equipped with a simple receiving set and the pilot wears ear phones over his helmet The letter "T" which, in the Morse Code is a prolonged dash, is heard repeatedly when the airplane is tuned on the proper frequency and flying on the course. Should the pilot deviate from the course a wavering signal is heard The pattern is shown on the map

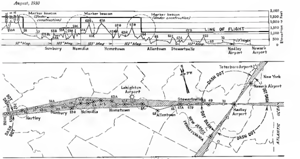
At the intersection of radio courses, a marker beacon is placed The marker beacon is a low powered transmitter which emits a distinctive signal on the frequencies of the two adjacent radio range beacons, and has a range of about three miles When the marker beacon is picked up, the pilot tunes his receiver to the frequency of the next range beacon ahead Marker beacons are also placed at critical points along the route to indicate an abrupt change in the altitude of the line of flight as shown on the map of air navigation facilities The marker beacon also serves as a mile post marker along the route to warn the pilot of his position

The radio range beacons are shut down every 15 min for the identification of the station by voice, broadcast

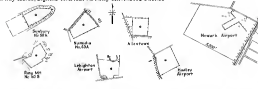


RADIO BEACON Hadley 290 KC When





RANGE SIGNALS — Cleveland 344 KC — Bellefonte 302 KC — on Airway Course, Signals Interlock Forming Continuous Dashes



on the same frequency followed by correct time and such weather information and warnings as may be necessary for the safety of the flight On the 15 min. broadcast periods, any message will be accepted and broadcast to the pilot in the air that is essential for safety of life and property

Plans are now under way for the installation of receiving equipment at the radio stations on this route to guard the calling and distress frequency set up by the Federal Radio Commission, 333 kc in the intermediate frequency band and 3106 kc in the high frequency band for emergency messages from airplanes equipped with transmitters If the demand develops for this type of service, the airways keepers at the principal weather and airplane reporting points along the route will stand a watch to report positions and other information concerning the safety of flight on the teletype circuit, is instantaneously made available at the offices of the transport companies' radio stations and Weather Bureau The facilities developed and proved on this route will be extended to other airways as fast as equipment can be provided and within the appropriations made available for air navigation facilities

Commencing at the Chicago Municipal Airport at Cicero, the focal point of a network of airways extending to nearly every point of the compass, the airway to New York is routed southeasterly to a turning point at the Ford Airport at Lansing, Ill This 25-mile stretch lies over the straggling southern suburbs of Chicago From Lansing, the course is almost due east, and for the next 20 miles skirts the south shore of Lake Michigan The course lies just south of the smoke projecting industrial center, Gary, Ind, but the first 50 miles from the Cicero Airport are often most difficult to negotiate because of the commingling of smoke and fog For this reason, the McCool intermediate field, almost on the edge of this zone, is an important weather reporting point The airway continues on practically a straight line over the level farm lands of Indiana and Ohio, until the Toledo airport is reached, some 225 miles from the starting point Lighted intermediate fields are available for landing at seven points before the Toledo airport is reached One of the courses from the radio beacon at Cicero is oriented directly on the Ford Airport at Lansing A radio marker beacon at this point warns the pilot to tune in on the Goshen radio beacon, which is followed until the Toledo radio marker beacon signals him to prepare for landing at Toledo or to retune his receiver to the Cleveland frequency Radio marker beacons at Helmer, Indiana, and Bryan, Ohio, give rough indications of the progress being made in the eastward flight from Goshen to Toledo, even though the ground may be invisible At Toledo the airway detours southerly to skirt the south shore of Lake Erie. At this point for about 60 miles the lighted course is actually south of the radio beacon course,—the latter lying over the water for about half this distance Lake mists frequently make flying difficult between Toledo and Cleveland, but the flat open country does not present the great hazard to low flying aircraft that the rolling country east of Cleveland does

The course of the Cleveland radio beacon from Toledo to Cleveland lies somewhat north of the lighted airway Radio marker beacons at Vickery and Vermillion indicate the progress being made on the flight and also the location of the two intermediate landing fields between Toledo and Cleveland

Weather reports are collected on a teletype circuit with six drops between Chicago and Cleveland, and are broadcast from radio communication stations at Maywood, Bryan, and Cleveland

Another center for airways extending in many directions is the Cleveland Municipal Airport The airport is equipped with the latest type of equipment, a fine administration building surmounted by a control tower and wind indicator The lighting system is thoroughly modern One of the Weather Bureau Airway Control Centers on the Transcontinental Airways is located at the Cleveland Airport

Until Cleveland has been left behind, the topography is of little interest Its chief feature has been its abundant landing places Immediately east of Cleveland, however there is a marked change, for the airway commences to traverse the back slopes of the Alleghenies Timbered areas make their appearance, and the cultivated fields become irregular in pattern Some few of these, lying in river bottoms or upon broad hill tops are flat and smooth but the greater portion are up-ended along the hillsides

Although this region affords scarcely any level areas of any size, there are no definitely marked mountain peaks or ridges until the Snowshoe ridge is reached only about eight miles from Bellefonte This high narrow wooded ridge extending northeast and southwest as far as the eye can reach is an unmistakable landmark

In the Bald Eagle Valley, under the steep eastern slope of Snowshoe almost every farm in a stretch ten miles either side of the course has been the scene of a forced landing at one time or another

From Chicago to Cleveland intermediate landing fields have been located at intervals approximating 30 miles From Cleveland to New York over the mountains, fields are spaced much closer,—at an average of more nearly 13 miles The easterly course of the Cleveland radio beacon extends to Brookville, Pa over six lighted intermediate landing fields A radio marker beacon at Mercer locates that intermediate field for the pilot who may not be able to see it, and gives him an indication of the progress he is making, while the radio marker beacon at the Brookville field indicates in addition, that it is time to retune on the frequency of the Bellefonte radio Beacon Intermediate landing fields at Dubois Curwensville, Clearfield, and Kylertown offers in case trouble develops between Brookville and Bellefonte

At Bellefonte is located what is probably the most frequently used intermediate landing field in the United States More than half of the scheduled aircraft flying from New York to Cleveland find it necessary to land at this field to renew the gasoline supply A radio communication station and radio beacon station are located at Bellefonte The first of the service type visual radio beacons is being installed at this point for service test in comparison with the standard aural type radio beacon generally used on Federal airways.

Easterly from Bellefonte the airway passes over a series of heavily wooded mountain ridges running practically parallel in a northeast-southwest direction It is this series of ridges which give the saw-tooth effect to the airway profile above the accompanying map, and this ground configuration extends to within 20 miles of Hadley Field,—the various summits decreasing steadily as the Atlantic Coast is approached But one generally level and open stretch of country is found in this region—the Susquehanna Valley in the vicinity of Sunbury Although the mountain ridges extend across the course, they are frequently notched, so that a pilot who knows his Pennsylvania can manage to fly from Sunbury to New York at an altitude not much above 1000 ft at any point But between Bellefonte and Sunbury, Woodward Pass, very little lower than the tops of the adjacent ridges, must be negotiated and this has been one of the particular stumbling blocks to the air mail pilots, for this valley, unlike the other valleys in this region affords no possible landing place should the pilot be trapped by a low ceiling Low ceilings,—right down on the tops of the mountains,—are frequent throughout the whole distance between Cleveland and New York Such low ceilings are frequently accompanied by ice forming temperatures in the colder months,—which more than doubles the hazard they present In the Fall morning and evening ground fogs are prevalent in the valleys and it is no uncommon experience for pilots to fly all the way to Bellefonte without sight of any land but the tops of mountain ridges, and then have to wait over Bellefonte for the sun to melt the fog or push on to the western side of the mountains where clearer conditions may usually be found Such conditions make the hourly collection of local weather reports and their broadcasting to the pilots of extreme importance; and justify the more than standard number of fields and beacons which have been established on this route.

The easterly course from the Bellefonte radio beacon passes over intermediate fields at Woodward Hartleton—whose location is indicated by a radio marker beacon—Sunbury, and Shamokin to Numidia. At the Numidia intermediate field, a radio marker beacon helps to locate the field Proceeding eastward on the course for Hadley intermediate landing fields are passed in quick succession A radio marker beacon located at Slatington indicates that the higher mountains have been passed and that a pilot may safely drop to an elevation of 1000 ft or so for the balance of the eastbound trip Two intermediate fields lie between Slatington and Hadley Field From this point, the aircraft wishing to terminate its flight at the Newark Metropolitan Airport, proceeds northeasterly on the Hartford course of the Hadley Field radio beacon for a distance of 17 miles

Between Cleveland and New York weather information is collected on the telegraph-typewriter service with drops at Cleveland and Parkman Ohio, Mercer Brookville, Curwensville, Kylertown Bellefonte, Winklebleck Mountain, Sunbury, Numidia Park Place, and Allentown Pa, and Hadley Field and Newark, N J, and is broadcast by radio telephone from radio communication stations at Cleveland, Bellefonte and Hadley Field Newark Airport is the eastern terminus of the Transcontinental and a good start has been made in its development It is the terminus of lines operating to Buffalo, Montreal Boston Pittsburgh and Atlanta Hadley Field located near New Brunswick, N J is the alternate landing field for exchange of mails at the eastern terminal of the Transcontinental

In the 740 miles between Cicero and Newark are 34 intermediate landing fields with a total area of 1765 acres 86 revolving beacons 3 flashing beacons, 4 radio communication stations, 5 radio beacons, 11 radio marker beacons and 21 teletype weather reporting stations which require a yearly expenditure of $288 000 for maintenance

Communications service on the route is maintained on a unified basis from the central office at Washington in charge of an Airways Traffic Supervisor Assitant Airways Traffic Supervisors are stationed at Cleveland Airport and Hadley Field as contact men with the transport companies and pilots to handle complaints and investigate reported interruption of service Personnel of the radio stations are directly under their control

The maintenance of intermediate fields and the airways lighting system is in charge of Lighthouse Service The Superintendent of Lighthouses Staten Island N Y, is in responsible charge of the airway between Bellefonte and the New York Terminal The Superintendent of Lighthouses Buffalo N Y is in charge of the lighting facilities between Cleveland and Bellefonte The route between Cleveland and Chicago is under the jurisdiction of the Superintendent of Lighthouses, Milwaukee, Wis All reports of outages and improper operation of lighting facilities should be referred to the respective district Superintendents The lights are maintained by airways mechanicians who visit the lights at frequent intervals and overhaul the equipment to keep it in efficient operation Each mechanician has a truck outfitted with tools and spare parts for this purpose Airways keepers are placed in charge of the facilities at weather reporting stations and give their entire time to the operation of lighting equipment maintenance of fields and reporting of weather conditions Part time caretakers are employed at other intermediate fields and beacon sites

THE INDUSTRY'S INCOME FOR 1929

By R. R. Doane

Finance is always the arena of universal rumor. Whispers of impending bankruptcy run a race with those of impending dividend declarations. Yet there is no field in which so much accurate and specific fact is to be had. Mr. Doane has compiled the record of the aircraft industry experience in 1929. It has much more than a merely historic value.

It is safe to say that the total gross income of the American Aeronautical Industry for both products and services during 1929 reached a sum in excess of $120 millions With the inclusion of individual company statements, yet to be reported, the figure would reach very close to $140 millions.

It is equally safe to say that the net sum retained by the industry, over that which was currently consumed during the processes of manufacture and of administration, including deductions for maintenance, depreciation and taxes, will approximate $13 millions, a sum exceeding the net earnings of the previous year by 15 per cent, while the total sum received by the owners of the industry, the shareholders, as disbursed in dividends, exceeded $1.6 millions

In many respects, for the industry as a whole, this discloses a somewhat surprisingly excellent record Especially when viewed in the light of the serious set-back encountered during the second half of the year, as well as in conjunction with a host of confused accusations of prodigality

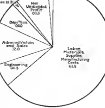


Chart 1 The Aviation Income Dollar for 1929

Fairly accurate and comprehensive estimates have previously been published by the Aeronautical Chamber of Commerce placing the total value of planes and engines produced during the year, both military and commercial, at about 98 million dollars These figures are obtained through 138 individual producing units in the industry, 95 commercial and 13 military plane producers, and 25 commercial and 5 military engine manufacturers They do not include, as many believe, separate estimates on volume of parts They are carefully checked against duplication, and undoubtedly represent a true estimate of value The totals as shown here in Table I are compiled from company reports, representing 112 individual producing units in all branches of the industry, which discloses a gross income from manufacturing operations, with a few companies missing, of an amount somewhat in excess of the Chamber's figure. However, only an approximation can be given, as in the case of some companies, notably Curtiss-Wright and United, no accurate division between manufacturing and transport income is made public.

Determination of Total Income

We are not in this study primarily engrossed with methods of calculation We are engaged only in the compilation of facts For the final determination of

the total income of an industry as well as for a knowledge of its distribution, the only source of dependable information is to be found in the individual reports of the corporations themselves

Out of 52 domestic aeronautical corporations, exclusive of those units already under control of the larger holding companies, we have tabulated data of 35 individual companies. The remaining seventeen have not reported, but as the companies on which data were received represent approximately 90 per cent of the total aircraft industry in America, both from the standpoint of capitalization and volume of business, we may consider the results of such a compilation as being a fairly comprehensive and accurate review of the industry for the period covered

Table I, here reproduced, affords a general portrayal of the financial results for the year past. A complete resume of the earnings of the major divisions of the industry is, of course, confronted with the obstacles of non-uniformity of statement, insufficient detail, and the obscuring of results in many of the important units through the rapid growth of holding companies. The reduction of the past year's income account to some common ground for comparative purposes thus becomes a

task of no simple proportions. Nevertheless, allowing for these transient difficulties, a definite idea can be obtained as to the total income and disbursements, especially for the more important items of both the manufacturing and transport divisions, even if it not as sharply detailed as a more scientific analysis might demand.

Significance of Ratios

In analyzing an industry's reports much depends upon ability to understand the effect of readjusted relationships brought into being through the industry's reactions to varying trade and general business conditions. Allowances for these variables in a young industry becomes less uncertain as time and experience accumulate, thus permitting of a far more accurate analysis than is at present possible

It then becomes not only helpful, but a sheer necessity, especially in these days when earnings statements are being scanned with more than usual care, to employ as many devices as possible for the throwing into sharp relief the important items in the statement

To be sure, it is not a difficult matter to tell whether or not a concern is making or losing money. What we want to know is "why" and "how," as well as "what."

One of the most important and simple standards or measures of efficiency in all lines of business is the percentage of total expense of running the enterprise, including manufacturing costs, selling and administrative, to the total operating income or net sales. This percentage is commonly known as the "operating ratio." It is clear that the difference between 100% which represent gross sales and the operating ratio is the percentage of operating profit on sales. This operating profit is generally referred to as "gross margin" and is the difference between total operating income and total operating expense.

The lower this percentage of gross profit—or the higher the operating ratio—the more unstable is the business as a money maker. In other words a high operating ratio means that even a slight variation in expenses may be sufficient to transform a profit into a loss, because of too small a *margin* within which to insure itself against a depression of business

Another important reason for the reduction of all income accounts to a uniform basis for accurate measurement, as in Table II, is that such treatment makes it possible to easily obtain the significant ratios. Without these ratios we remain very much in the dark, not only in regard to the individual company's efficiency in manage-

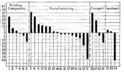


Chart 2B Ratio of Total Profit or Loss to Total Capital Investment

Key to Bottom Figures
1 United Aircraft
2 North American Aviation
3 Fokker Aircraft
4 Curtiss-Wright
5 Aviation Corp.
6 Detroit Aircraft
7 Consolidated Aircraft
8 Ex-Cello Aircraft
9 Douglas Aircraft
10 Waco Aircraft
11 Aero Supply Mfg
12 Irving Air Chute
13 Stinson Aircraft
14 Glenn L. Martin
15 Kinner Aircraft
16 Nicholas-Beazley
17 Dayton Airplane Engine
18 Warner Aircraft
19 Bellanca Aircraft
20 Consolidated Instrument
21 Alexander Industries
22 Fairchild Aircraft
23 Western Air Express
24 National Air Transport
25 Aviation Corp of Amer
26 T A T
27 National Aviation
28 Air Investors
29 Aviation Securities

Table 2—Financial Results for 1929 of 35 Representative Aeronautical Companies

(000 Omitted)

Company	Total Assets	Net Working Capital	Outstanding Capital Stock	Surplus	Total Capitalization and Surplus	Gross Income 1928	Gross Income 1929	Net Income 1928	Net Income 1929	Earnings per Share	Book Value per Share
Holding Companies											
Aviation Corporation	$39 127	$21,593	$31 755	$4 201	$35,056	$3 400*	$6 189	$787	*$1 444d*	Nil	$11 22
Bendix Aviation Corp †	70,986	22 030	52,436	11 076	65 512	1,227**	2 777**	245*	556*	$3 54	15 20
Curtiss-Wright Corp	78,473	17,656	48,862	12,331	61 293	19 522†	28 423	4 974	*688d*	Nil	8 48
Detroit Aircraft Corp	6 420	5 425	5 432	0	1 452	560†	837		*738d*	Nil	6 84
Fokker Aircraft Corp	12,373	8,862	5 730	8,255	13,985	2 000*	2,700*		403	37	12 73
North American Aviation	27,228	18 253	25 000	1 667	26 667	62	2 303	8	1,938	95	11 91
United Aircraft & Trans	41,331	24 292	26,494	10,830	37 324	17,028	35 206	4,641	8,066	4 52	13 40
	$275,036	$116,231	$195 889	$46,360	$242 169	$44 581	$77 948	$6 014	$8,088		
Manufacturing Companies											
Aero Supply Mfg. Co.	$2,129	$893	$1,752	$263	$2,015	$715	$2,001	$113	$225	$ 40	$5 14
Alexander Industries, Inc.	2 907	535	1 284	246	1,130	1 855	2,450*	162	*286d*	Nil	
Allied Motors Industries‡							687	340	212		
Bellanca Aircraft Corp	1 992	1 237	1,280	0	1,280	201	679	*280d*	*109d*	Nil	9 90
Berliner-Joyce Aircraft	700	152	648	0	648						
Consolidated Aircraft	3 972	1,313	21	3,853	3 878	5 143	2 668	1,315	952	1 64	5 58
Consolidated Instrument	1 361	201	1,227	0	1 227	499	888	102	*288d*	Nil	
Douglas Aircraft Corp	3,283	2,444	1 697	1 403	3,100	1,960	2 637	371	483	1 19	9 20
Ex-Cell-O Aircraft	3,434	1 279	2,519	397	2 916	2 752*	4 800*	280	719	2 15	
Irving Air Chute	063	798			667	1,656	2 260	414	451	2 16	
Kinner Airplane & Motor	2,035	829							*59d*	Nil	70
Nicholas-Beazley Airplane					580	1,120*	163	224	*11d*		
Glenn L. Martin Co., Inc.	5,767	1 716			4 617	2,631	4,270*	526	36	05	
Stinson Aircraft Corp	405	235			554	1 169	1 362	120	14	11	4 40
Waco Aircraft Corp	1,008	564			865	2 176	2 017	304	100	75	6 40
Warner Aircraft Corp	1 065	518			959	185	638	*24d*	*40d*	Nil	2 10
	$28 730	$12 126	$10 932	$5 362	$24 756	$20 065	$27 090	$4 155	$2 621		
Transport Companies											
Aviation Corp. of America	$6,662	$3 599	$6,417	0	$6 417		$4,035		*$327d*	Nil	$18 00
National Air Transport	4 311	1 071	3 232	$341	3,573	$1,652	2,652	$274	669	$1 03	5 59
N. Y., Rio & Buenos Aires	5 480	548	3,480	0	3 480						
Stout Air Lines	1 260	473			1 223						
T A T	7 588	3 020	5 214	1 900	7 114		785		*307d*	Nil	8 58
Western Air Express	5 925	1 617	1,347	2,178	3 525	1,348	3 043	631	1 087	7 11	36 10
	$27 226	$9 228	$19 690	$4 410	$25 332	3,000	$10 513	$909	$452		
Airports											
Central Airport Corp	$2 062					..			*$10d*	Nil	
Roosevelt Field Inc	5 040	$1,113	$4,975	0	$4,975				11	$ 15	
	$7 102	$1 113	$4,975	0	$4,975				*89d*		
Finance Companies											
Aero Underwriters	$1 416								$140	$1 99	$31 03‡
Aviation Credit Corp					$5 000				275	1 18	21 88
	$1 416				$5 000				$415		
Investment Companies											
Air Investors, Inc.	$4 934	$4 906	$4 770	$136	$4 906		$384		$126	$ 08	$11 10‡
National Aviation	5 584	5 429	5 598	1,705	5 504		358		242	41	11 54
	$10 518	$10 335	$5 368	$1 841	$10 210		$662		$368		
Totals	$310,028	$149 083	$236,774	$57 982	$312 442	$67,646	$116 221	$11,078	$12,836		

NOTES *Estimated **Proportion realized from aircraft sales only †Constituent Companies ‡Only partially aeronautical ‡Liquidating value year end
Wherever blank spaces are found it means no late reports are available *Italics* mean net loss for year •Common stock

ment, but to the soundness or relative weakness of the entire industry as well

It is obvious that in a company with large original capital resources, where it is possible for "other income" (from investments) to be a large factor, that it would be a simple matter to conceal deficiencies in operation, and regulate to a marked extent the fluctuations in

What we are really trying to do in the analysis of the industry's earnings is to discover its unadulterated ability to produce the necessary income from its own operations Thus the first, and obvious step is to determine its *margin of operating profit*

As an illustration of our method of calculation of gross margin we have included selling and administrative expense as part of the total costs This was necessary because of the fact that most of the income reports made no separation of these items

A brief examination of Table II discloses wide fluctuations, but an average ratio of just over 80 per cent among the holding companies, and a slightly lower average ratio among the smaller independent manufacturing group, as against a decidedly low operating ratio among the established air mail operators in the transport division Since these holding companies do not segregate revenues and expenses between their transport and manufacturing units in the income report it is of course impossible to obtain a true ratio for a single one of their activities, but we do get an average ratio of both manufacturing and transport when taken together

Another illustration of a financial statistical unit of measurement is the so-called "rate of turn-over of working capital," which is merely the ratio of gross sales to the working capital carried during a given period This becomes of particular interest as applied to aviation's financial performance, especially because of the large financing undertaken during 1929 and of the lack of sufficient past experience to determine accurately the amount of working capital required Each individual company has had to solve this problem—and in proportion to the amount of its funds invested in working capital it has been interested in the problem of turnover

This factor, because of the significant changes noted in the year-end reports in the ratios of current liabilities to current assets, has caused considerable unnecessary confusion in the average investor's mind.

In this respect it may be stated that the seasonal nature of an industry and the length of time required for manufacture are the major factors in the determining amount of working capital required

Thus the ratio of working capital to total capital should be more or less uniform in the same divisions of the industry.

Guides to Earnings

Without becoming needlessly tedious in explaining the value of a clear understanding of gross margin and operating ratio we cannot drop the matter without pointing out that fluctuations in operating expenses do not rise or fall in equal degree to gross returns Operating expense always increases at a more rapid rate, proportionately, than the actual rate of decline in gross earnings This may be seen in Chart 3 which shows an average division between "fixed" and "variable" charges It is also clear for obvious reasons, that it is far more difficult for a transport operator greatly to reduce his operating costs during periods of dull business than it is for the manufacturer

Table II—Comparative Analysis of Income Results for 1929

(000 Omitted)

Company Classification	Net Sales Operating Income	Cost of Sales Operating Expense (1)	Gross Margin Operating Profit (2)	Per Cent of Gross Margin to Net Sales	Operating Ratio Per Cent of Cost of Sales to Net Sales	Other Income	Total Income	Total Expense (3)	Per Cent of Other Income to Total Inc.	Profit or Loss	Ratio of Profit or Loss to Total Cap	Dividends Paid
Holding Companies.												
Aviation Corp	$5,080*	$5 952	$878 def		117 2	$1 509	$6 589	$8 055	22 9	$1 444 loss	—04 0	
Curtiss Wright	28 048	23 589	2 459	09 4	90 6	2 375	20 423	29 092	08 3	669 loss	—01 0	
Detroit Aircraft	632	1 206	560 def		144 1	119	955	1 688	12 3	733 loss	—13 4	
United Aircraft	31,424	21 660	9 764	31 0	69 0	1,782	35 206	24 250	05 5	8,966 net	24 0	$672
	$63 389	$52,407	$10 952 net		82 6	$5 784	$69 173	$63 051		$6,120 net		$677
Accessories												
Aero Supply Mfg	$1 989	$1 675	$514	15 7	84 3	$16	$2 005	$1,782	00 7	$225 net	11 0	$61
Consolidated Instrument	688	763	75 def		110 9	0	688	793	0	105 loss	—08 5	
Ex Cell-O Aircraft.	4 809	3 954	855	17 7	82 3	0	4 609	4 090	0	719 net	24 6	240
	$7,486	$6,392	$1 094 net		85 4	$16	$7,502	$6,665		$857 net		$301
Planes												
Bellanca Aircraft	$564	$762	$100 def		135 1	$116	$680	$783	17 0	$100 loss	—06 1	
Consolidated Aircraft	2 619	1 526	1 095	41 7	58 3	40	2,668	1 716	01 8	952 net	31 1	
Douglas Aircraft	2,546	2,161	365	15 1	84 9	91	2 637	5 040	05 4	403 net	15 01	$254
	$5 729	$4 449	$1 280 net		77 7	$233	$5 985	$5 545		$1,246 net		$254
Transport (1a)												
Aviation Corp of Am	$5 906	$4 325	$419 def		110 7	$127	$4 035	$4 523	03 1	$795 loss	—04 4	
N A T	2,565	1,929	654	24 7	73 3	81	2 652	1,983	05 5	669 net	18 7	
T A T	479	1,771	1 292 def		370 0	304	705	1,770	58 8	897 loss	—13 0	
Western Air Express	2,950	1,955	995	33 6	66 4	93	3 045	1,956	03 0	1 087 net	30 8	$57
	$9,900	$9,981	$81 def		100 8	$615	$10 515	$10 032		$401 net		$52
Totals	$86 504	$73 229	$13 275 net			$6 668	$93,173	$65,295		$8 684 net		$1 210

(1) Includes all manufacturing costs, labor, engineering, materials, royalties, selling and administrative expense and inventory adjustments
(1a) Includes cost of operation maintenance and depreciation
(2) Net earnings from sales after deduction of all manufacturing costs including selling and administration.
(3) Also includes deduction for minority interests in profits of subsidiary companies

Table III—Division of 1929 Income

Groups	No. Reporting Gains	No. Reporting Losses	Total	Amount $1,000 Net	Amount $1,000 Def	Net Gain $1 000 Omit
Holding Companies	4	3	7	$11,855	$2,845	$8 988
Manufacturing Cos.	10	6	16	3 213	592	2 621
Transport Cos	2	2	4	1,758	1,304	454
Airport Companies	1	1	2	11	19	8
Finance Companies	2	0	2	413	0	415
Investment Cos	2	0	2	360	0	360
	21	12	33	$17 590	$4 760	$12 838

Table IV—Dividends Paid by Aircraft Companies During 1929

(000 Omitted)

Company	Annual Rate	Classification of Stock — Preferred	Classification of Stock — Common	Total Amount
Aero Supply Mfg.	$1 50		"A" $61 344	$61 344
Alexander Industries	.04		12 000	12,000
Douglas Aircraft	.75		254 250	254 250
Ex-Cell-O Aircraft	1 20		240 000	240 000
Irving Air Chute	1 30		315,500	315 500
United Aircraft	3 00	$671 617		671 617
Waco Aircraft	.25		36 500	36 500
Western Air Express	.60		51,914	51 914
Totals		$671 617	$969,508	$1 641 135

Table V—Inventory Changes

(000 Omitted)

Company	1928	1929	Increase	Per Cent
Bendix Aviation	$3,514	$5 239	$1,725	49 0
Curtiss Wright	10 399	14,217	5 818	56 7
Detroit Aircraft		944	667*	240 0
Fokker Aircraft	1 465	2,189	726	49 6
United Aircraft	4 074	7 633	3 559	87 3
Aero Supply Mfg	250	539	289	113 0
Bellanca		545		
Consolidated Aircraft	425	1 426	1,000	235 0
Douglas Aircraft	350	982	632	180 0
Fairchild	750	1 590	840	112 0
Kinner	118	567	449	380 0
Waco	309	334	25	8 0
Stinson		156		
Warner	114	622	508	445 0
Totals	$22,043	$36 983	$14 939	67 7

*Estimated

Table VI Banker's Birds-Eye View

(Average Ratios Aeronautical Companies Reporting Net Income for 1929)

Items	Holding Companies	Accessories and Parts	Planes	Transport
Current Asset Position				
(1) Cash	6 2	4 1	9 1	6 5
(2) Quick assets	8 7	7 8	14 1	7 0
(3) Inventory	277	418	373	68
Capital Position				
(4) Debt	109	057	058	113
(5) Fixed assets	304	470	.164	.545
(6) Utilization of plant.	2 436	1 728	4 300	1 021
Turn-over				
(7) Inventory	3 7	6 7	3 2	....
(8) Working capital	1 2	2.7	1 0	1 8
(9) Total capital	0 8	1 6	1 8	0 8
Earnings				
(10) Gross margin	309	167	.161	336
(11) Net on sales	285	.150	.150	568
(12) Net on capital	240	178	130	308

(1) Cash assets divided by current liabilities.
(2) Current assets, minus inventory divided by current liabilities
(3) Inventory divided by current assets
(4) Total liabilities except capital and surplus, divided by capital and surplus.
(5) Plant and permanent investments divided by capital and surplus
(6) Cost of product divided by plant and building account
(7) Cost of sales divided by average inventory
(8) Total net sales divided by total net working capital
(9) Net sales divided by capital and surplus.
(10) Operating profit divided by net operating income.
(11) Net earnings divided by sales
(12) Net earnings divided by capital and surplus.

Division of Income

One of the interesting features of this summary is that the year 1929 did not prove as disappointing from the standpoint of net earnings as was at one time feared In fact, as disclosed in Table III, about two-thirds of the corporations were able to close the year with a profit, with the greatest losses falling among the smaller manufacturing companies Proportionately, the profits and losses were rather equally spread over the entire industry as may be seen from a glance at Chart 2 (the list of companies included there is not identical with that in Table II)

When we look at the aviation income dollar, Chart 1, we also see that it conforms with remarkable similarity to the income dollar of the average American industry

For a number of years the average net return has stood at approximately 10.6% to gross sales. Since 1921 this has fluctuated around a very narrow margin of between 10.4 and 10.7. As these are the figures of the Federal Reserve Board, obtained from over two hundred thousand reporting corporations they may be taken as an adequate measure of the normal and average profit. It is, however, a singular coincidence that this average rate for the aircraft industry stood at exactly 10.6 for 1929.

However it must not be overlooked that although the industry shows a 15.8 per cent gain in net income over 1928 it also shows a 71.8 per cent gain in gross income over the same period, and that the percentage of net income increase did not follow this gross increase anywhere near proportionately. The optimism of the time accounts for much of this, as a glance at the table of inventory changes (Table V) will disclose. Increased engineering research and long-range development work, with their attendant high expense probably account for an equal amount.

Aviation Investing Companies

The rôle of the investment trust in aviation is a difficult one. Difficult because at the outset it is limited, in theory, to a single field. Often such concerns soon become important holding companies, with a growing voice in the management of the corporations in whose securities they have invested. Many, however, continue to spread their investments over a broad field including the securities of outside industrial concerns whose products and services are of indirect support to this industry. There can be but little doubt that the managements of these companies, due to their first-hand knowledge of aviation, are in an excellent position to exercise far better skill in efficiently placing capital at the disposal of the industry and with more profitable and effective results, than is the average layman.

As evidence of this ability it will be seen that the two investment companies included in Table I were able not only to *not suffer losses* during the past year but were able to earn some return on their capital in face of a falling market (price changes on securities retained in their portfolios not ordinarily being taken into the income account). It is extremely doubtful that the individual who wants to encourage aviation by a capital investment, or who thinks he may make money more rapidly in this industry during the next decade than in most others, could have done as well.

Chart III: Comparative Fixed and Variable Charges in Percentage of Total Operating Expense

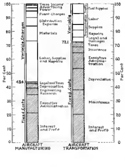
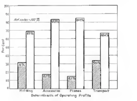


Chart IV: Total Operating Expense (white) and Gross Margin Comparisons (shaded)



Standard Rate of Profit

In any analysis of the distribution of income received by an industry a consideration of profits is the prime objective. We find in Chart 1, that by far the major portion of each dollar received went for labor and raw materials, a large portion to depreciation with a somewhat larger share to engineering work. The majority of the elements constituting this expense, such as rent, interest, price of raw materials, wages, etc., are paid out—but profits belong to the corporation making them. They are the measure of its success. The normal rates for wages, materials and the other items are largely fixed in advance. They thus constitute the conditions that the company or industry must meet. But the profits made are not so easily determined. These depend largely upon managerial ability and the ever changing conditions within the distributing market.

As an aid in measuring the success of this industry it would prove of advantage to know what is generally considered as an average fair rate of return on capital. Since the days of Adam Smith "double interest" or 12 per cent has been universally held as a liberal rate. Double interest, according to authorities, is the best general measure of the possible profits of successful enterprise. This rate may of course be exceeded for brief periods by new and rapidly growing industries, as well as by individual concerns within stabilized industries. It has been exceeded in certain instances within this industry during the past year. But in the end, and usually within a five-year period, any abnormal earnings will display tendencies to swing back into line with those rates determined by economic laws and competition.

THE FASTEST COMMERCIAL AIRPLANE

By Leslie E. Neville
Technical Editor of Aviation

Considering the large number of low wing monoplanes introduced during the past few months and the probability that a number of machines of this type will participate in the National Air Races this month, it is timely to focus attention on the Travel Air "Mystery S" low wing monoplane. This airplane was widely discussed following its brilliant performance in the National Air Races of 1929 and undoubtedly was one of the large contributing factors in the trend toward the low wing monoplane which is now apparent. The present article is a discussion of the aerodynamic and structural characteristics of this airplane.

What is probably the fastest commercial airplane thus far constructed in this country is the "Mystery S" low wing monoplane developed by the Travel Air Co., division of Curtiss-Wright Corp. The first of these airplanes was completed in August, 1929, and its high speed performance was one of the outstanding events of the National Air Races. In the Free-for-all race of September 2nd the Mystery S attained a high speed of 194.9 m.p.h., which was several miles an hour better than its military competitor. Subsequently this was increased by some 15 m.p.h.

At the National Air Races there was also another model of the same airplane powered with a Chevolair inverted in-line engine. The Wright powered participant in the races was flown by Doug Davis of Atlanta, Ga.

This prize winning plane was designed by H. Rawdon and W. E. Burnham as a sport and racing plane. Work on the design began in the summer of 1928 and the airplane was built rigidly to design specifications. It is a surprising fact that on its first test flight the airplane performed in excess of the predictions of the designers. The original plane was powered with a special Wright R-975, nine-cylinder Whirlwind engine developing approximately 400 hp. at 2,300 r.p.m. The increase in power over the standard 300-hp. Whirlwind was obtained

by augmenting the compression ratio and the speed of the supercharger. Because of this method of increasing power a rather surprising fuel consumption economy at cruising speed was observed. According to the manufacturer, the gasoline consumption at 1,550 r p m (150 m p h), was 13 gal per hr

The Travel Air Mystery S is a typical low wing monoplane having a span of 29 ft 2 in and an overall length of 20 ft 2 in. The height overall is 7 ft 4 in. The weight empty is 1 475 lb and the disposable load 465 lb., giving a gross weight of 1,940 lb. With the 400-hp engine the power loading is but 4 6 lb per hp. The wing loading is 15 5 lb per sq ft

The Mystery S was designed for a load factor of 12 in high angle of attack condition. The load factor for low angle of attack is 8 and for nose dive and inverted flight conditions this value is 4. The factor for landing gear and fuselage in the level landing condition and the three point landing condition is 7. In static tests the horizontal control surfaces withstood a loading of 50 lb per sq ft and the vertical control surfaces 37 5 lb per sq ft

Despite the remarkable performance of this airplane there is nothing revolutionary in its design. Aerodynamically it is a conventional low wing monoplane streamlined to the highest possible degree and embodying practically every known device for the reduction of drag. Tapered wings, wheel fairings, and elliptical fuselage section all contribute to the overall efficiency and even the rudder is so constructed that its lower portion carries the streamlining of the fuselage to a sharp edge at the rear.

The R A F No 34 airfoil section, maximum L/D = 20 6, is used. The wing is carefully filleted at its attachment to the fuselage and is tapered in plan form and thickness from the strut point to the tip. Wings are set at an incidence of 2 25 deg and a dihedral of 4 deg. There is no sweepback.

External bracing is effected by the use of streamline wires attached to a cabane which is concealed beneath the cowling and behind the engine.

Wing panels are hinged to stubs projecting outward from the fuselage about 25 in. The ends of these stubs extend to a point over the wheels of the landing gear.

Internally the wing structure is generally conventional in design. Spruce and Haskelite three-ply $\frac{1}{16}$-in. mahogany plywood are used in the construction. Spars are built up of two spruce beams glued together and not routed. Ribs are built up of $\frac{3}{16}$-in square spruce strips with $\frac{1}{16}$-in mahogany plywood gussets at the joints and are secured to the spars by the use of glue with a nail at each point of contact to maintain position during the glue drying process. A filling strip is placed between the ribs on the top and bottom of the spar and parallel to it producing an even contour along the entire length. Compression ribs are built up of spruce trussing boxed with plywood webs, nailed and glued in place on the spars with angle block. In addition to the plywood covering, tie rods are employed in the drag bracing. The leading edge is covered with 2-in. tape to prevent the plywood from breaking out over the bend, while the trailing edge is of spruce. All fittings are of chrome molybdenum steel and are enclosed. The wing is covered with plywood.

Maximum chord of each wing is 60 in. and the total area of the wings is 125 sq ft. Ailerons are built up of chrome molybdenum steel and covered with fabric. Each aileron is attached to a false spar by three inset hinges. They are controlled by a steel torque tube actuated by a differential push and pull tube system, providing an angular travel of + 35 to — 25 deg. The span of each aileron is 6 ft and the chord is 1 ft $1\frac{1}{2}$ in. The total aileron area is 12 3 sq ft

In order to provide a desirable compromise between cockpit capacity and frontal area the fuselage is made wedge-shaped. Structurally it is conventional in that it is built up of welded steel tubing with an absence of internal wire bracing. Longerons are of $\frac{7}{8}$-in. x 0 035-in and 1-in x 0 049-in tubing. The finished fuselage is faired out to a nearly elliptical cross section through the use of a spruce superstructure covered with $\frac{1}{16}$-in mahogany plywood. Metal cowling extends from the engine compartment back as far as the cockpit on all sides.

One of the unique features of the Travel Air Mystery plane is the landing gear. The method of mounting the shock absorber and of attaching the landing gear to the airplane is quite unusual. The shock absorbing device in conformity with Travel Air practice is a combination oil and coil spring mechanism with the oil cylinder used to absorb the initial landing load and the spring for the purpose of taxiing. Vertical "N" struts are used to attach each unit of the landing gear to the ends of the wing stubs and each wheel is braced laterally by streamline wires attached to its wing and to the opposite wing stub, the former constituting the external wing bracing wires. The shock absorbing device consists of two oil cylinders and four coil springs with the wheel slung between. It is located at the lower end of the "N" struts. The entire mechanism and most of the wheel are enclosed in a streamline cover of 0 040-in aluminum. Wheels are 24-in x 4-in Bendix. Brakes and tires are the same size.

In conformity with the attempt to reduce parasite resistance to a minimum an extremely short tail skid, fitted with a shoe and completely streamlined, is employed. An oil spring shock absorber is fitted to the upper end of the tail skid beam which is hinged to the lower member of a bulkhead. When the tail skid is on the ground, the thrust line makes an angle of 13 deg with the horizontal.

Both horizontal and vertical tail surfaces are constructed of steel tube spars and stamped steel ribs and all are covered with fabric. The stabilizer span is 8 ft 10 in and the maximum chord 2 ft $3\frac{1}{16}$ in. Each elevator has a span of 4 ft 2 in and a maximum chord (hinged to trailing edge) of 1 ft $5\frac{1}{2}$ in. The stabilizer is adjustable in flight through a range of + 2 to — 4 deg and its area is 14 1 sq ft. The elevator area is 9 4 sq ft and the travel + 37.3 to — 25 6 deg. The elevators are not balanced and the distance from their hinge line to the center of gravity of the airplane is 13 ft 2 in

The vertical fin is adjustable on the ground and has a maximum length of 2 ft $\frac{1}{2}$ in. Its mean height is 2 ft $8\frac{1}{2}$ in and its area 4.1 sq ft. The height of the rudder is 4 ft 5 in and the maximum chord (hinge to trailing edge) 1 ft $7\frac{1}{2}$ in. The rudder has a range of travel of + or — 35 deg and an area of 5 7 sq ft. The distance of its hinge line from the center of gravity of the airplane is 13 ft 8 in. As in the case of the elevators, the rudder is unbalanced.

Cable control is employed for both rudder and elevators.

As in the case of a number of contemporary commercial airplanes, the welded steel tube engine mount is detachable. The mounting ring is $1\frac{1}{4}$ in x 0 083 in. Two fuel tanks are provided. One, the main tank, in the fuselage supported on the longerons, is constructed of 0 040-in. aluminum sheet. A five-gallon reserve tank is located behind the main tank and connected to it only by a wobble pump. The capacity of the main tank is 42 gal and gravity feed is employed between it and the engine, $\frac{1}{2}$ in gasoline lines being used throughout the fuel system. The main gasoline tank is located exactly on the center of gravity of the airplane which is located 24 percent backward along the chord. Inasmuch as the gasoline constitutes nearly all of the variable load, the static balance is practically constant.

The fire wall is 0 040-aluminum alloy sheet. This same thickness of stock is used in the inner and outer engine cowlings as well as the cowling of the forward portions of the fuselage behind the fire wall. The Venturi cowling has no cooling baffles between the cylinders. The inner cowling extends back to the cockpit. An oil radiator is mounted in the wing stub and the cooling fins form the walkway. An 8-ft diameter Standard Steel propeller is used set at a pitch of 22 6 deg.

The usual instrument equipment as well as a safety belt and fire extinguisher are included in the pilot's cockpit and the engine control bracket consisting of throttle, spark plug and mixture levers is located at the pilot's left. The specifications according to the manufacturer are as follows

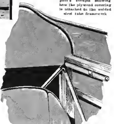
Length Overall	20 ft. 2 in
Height Overall	7 ft 9 in
Airfoil (Wing Section)	R.A F 34
Span Each Wing	29 ft 2 in
Chord, Each Wing	60 in
Area of Wings Total	125 sq ft.
Area of Ailerons	12 3 sq ft.
Area of Horizontal Stabilis	14 1 sq ft.
Area of Elevators	9 4 sq ft
Area of Fin	4 1 sq.ft.
Area of Rudder	5 7 sq ft.
Weight Empty	1 475 lb
Disposable Load	465 lb
Gross Weight Loaded	1 940 lb
Power Plant	Special R [illegible] 400 hp at 2,300 r p.m.
Wing Loading	15 5 lb
Power Load	4 6 lb.

Rear view showing highly streamlined fuselage of the Travel Air "S"

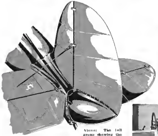
Profile view showing N A C A cowling and wheel fairings

DESIGN AND CONSTRUCTION OF THE TRAVEL AIR "S"

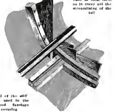
Front view of the Travel Air "S" low wing monoplane showing the landing gear and external wire bracing



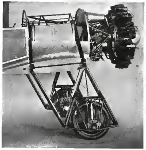
Below: A corner of the pilot's cockpit showing how the plywood covering is attached to the welded steel tube framework



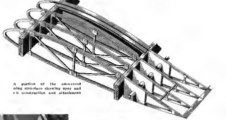
Above: The tail group showing the lower portion of the rudder which is built in such form as to carry out the streamlining of the tail



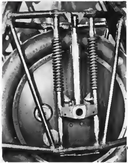
Detail of the stiffeners used in the plywood fuselage covering



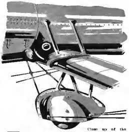
Uncovered structure of the forward portion of the fuselage, the engine mount and the landing gear



A portion of the uncovered wing structure showing spar and rib construction and attachment



A close up of the landing gear shock absorber mechanism with the wheel fairing removed



Close up of the attachment of wing to fuselage showing the external struts and wires and the wheel fairing

The N.A.C.A. cowling installation on the radial engine model

HOW FAST IS MAXIMUM SPEED?

By Professor Elliott G. Reid

Stanford University

SEVERAL months ago, my analysis of airplane landing speeds appeared in these columns with the apparent result of arousing considerable interest and, perhaps, of quenching some unwarranted enthusiasm The evidence of somewhat widespread interest in the application of basic aerodynamic principles to the prediction and analysis of airplane performance has been the incentive for the preparation of this discussion of maximum speeds

In the previous paper, the reader's attention was drawn to the fundamental relation between wing loading and landing speed which makes the separation of the sheep from the goats, as regards advertised landing speeds, a rather simple matter When we come to consider the other end of the speed range, the question can not be settled in an equally direct manner However, it is hoped that the analysis presented herewith will provide a more substantial basis for the consideration of the top speed problem than has been available heretofore by directing attention to the fact that the maximum speed of an airplane depends upon only three basic factors, the influences of which may be easily visualized and accurately predicted

The principal object of this note is to show that the practical influence of the first of these three factors (propeller efficiency) is so small that the great variation of top speed among existing airplanes having proportionate power (the second factor), is simply evidence of the variety of success attained by different designers in their common endeavor to reduce the top speed drag coefficient (the third factor)

In addition, although no specific cases are cited—for obvious reasons—it is inferred that some manufacturers, who appear to be more enthusiastic in their advertising than thorough in their performance testing, might do well to calculate the apparent values of drag coefficient which

Curtiss PW-8A—P/S = 1 [illegible] hp./sq. ft. Vmax = 172 m.p.h

Savoia Marchetti S-64—P/S = 0 775 hp./sq. ft. Vmax. = 146 m.p.h

corresponds to the advertised top speeds of their airplanes and to ponder upon the results

To develop the fundamental relation upon which the analysis is based, we begin with the equation for the thrust power required to propel an airplane in horizontal flight It is

$$P_1 = DV_1 \tag{1}$$

wherein P_1 is thrust power required, in ft.-lb. per sec D is the drag, in pounds, and V_1 is the velocity, in ft per sec If we now introduce

$$P_1 = 550\eta P$$

and $$D = C_D'S\rho V_1^2/2$$

and express velocity in m.p.h., equation (1) becomes

$$550\eta P = 1.466^3 C_D'S\rho V^3/2 \tag{2}$$

The symbols are defined as

η = propeller efficiency

P = required engine power (b.hp.).

C_D' = drag coefficient corresponding to top speed

S = wing area (sq ft)

V = velocity (m p h)

ρ = mass density of air (slugs/cu ft)

The solution of equation (2) for V yields the desired result

$$V = 53.06\sqrt[3]{\frac{\eta P}{C_D'S}} \tag{3}$$

For our purposes, it is convenient to consider the four quantities under the radical as comprising three independent factors, namely, η, P/S, and C_D

The above relation is not at all new either in substance or in form In fact, this or a similar equation has served as the basis for many charts used for the approximate prediction of airplane top speeds The best known form of such a chart is that of Fig 188 in E. P Warner's "Aerodynamics" In such charts, which have V as abscissa and P/S as ordinate, we find a wide band of established points as the guide for predicting the performance of a new machine. The charts which are presented below have the same coordinates as the familiar form of graph (interchanged) and some additional features which are described later and add considerably to the usefulness

Let us consider the three factors separately; a study of their influences upon top speed and of the effects of the practical limitation of their values clarifies the problem of prediction and analysis.

Equation (3) indicates that top speed varies with the cube root of propeller efficiency Current practice is to choose a propeller which will, practically, develop its maximum efficiency at maximum speed in level flight. The peak efficiencies of modern, conventional propellers, however, vary only within relatively small limits Professors Durand and Lesley, who have been engaged in air propeller research for fifteen years, have coined an amusing and very true precept, "It is about as difficult to design anything which resembles a propeller and develops an efficiency of less than 65 per cent as it is to obtain more than 85 per cent efficiency." It is generally accepted that a propeller which will have an efficiency of between 70 and 80 per cent at top speed in level flight can be designed for almost any airplane It is my opinion that the great majority of propellers fitted to airplanes of current design have top speed efficiencies of 73-77 per cent; the growing popularity of standardized metal propellers lends support to this view Even though the limits of practice be set at 70 to 80 per cent, the corresponding top speeds will vary by only ±2.2 per cent from those for the mean value of η = 75 per cent, whereas the range for $73 < \eta < 77$ per cent is but ±0.9 per cent. It is apparent, then, that the effect of the probable difference of η upon the top speeds of airplanes having fixed values of P/S and C_D is very small indeed The factors of equation (3) are, thereby, effectively reduced from three to two If we take $\eta = 0.75$ as the average value, equation (3) becomes

$$V = 48.2\sqrt[3]{\frac{P}{S} \times \frac{1}{C_D'}} \tag{4}$$

ELIMINATION of the variable η enables the rational comparison, from an aerodynamic viewpoint, of the high speed performance of all airplanes. The comparison of the top speeds of airplanes of proportionate power has been referred to above; the term proportionate power

There is probably nothing in the aeronautical industry more subject to criticism than the advertised performance figures of certain commercial airplanes. Several months ago an article by Professor Reid was published on the deplorable condition existing in the matter of advertised landing speeds (AVIATION, issue of July 20, 1929). ¶In the present paper Professor Reid simplifies much of the mathematics normally associated with the prediction of maximum speed and compares the advertised figures for a group of commercial planes with the figures obtained by actual test for a group of typical service planes.

was used to express equality of the power : area ratios. Equation (4) indicates, as would be expected, that airplanes having equal drag coefficients and equal P/S ratios will attain equal maximum speeds It also shows that a given maximum speed may be attained by an airplane with a small power : area ratio if the value of C_D' is proportionately small or, in other words, that the penalty imposed by a large drag coefficient is a large power requirement.

Navy PN-9 Flying Boat—P/S = 0 78 hp/sq ft V_{max} = 116 m p h

The most valuable feature of this relation is Knowledge of engine power, wing area, and top speed of an airplane is sufficient to determine, with good accuracy, the value of C_D', thus making possible the desired comparison of the aerodynamic merit, as regards top speed, of all airplanes This comparison is made with a minimum of labor by the use of a chart of the form of Fig. 1. (Logarithmic coordinates are used so that exponential relationships between ordinate and abscissa may be represented by straight lines) The two heavy lines across the chart represent the top speeds, which will be attained by airplanes having C_D' values of 0.06 and 0 03, respectively, as functions of the ratio P/S, the propeller efficiency being assumed as 75 per cent The two broken lines are added to show the magnitude of the differences of top speed introduced by ±5 per cent variation of η As an example of the use of this chart let us suppose that three airplanes have the following characteristics:

	Engine Power	*Wing Area*	*Top Speed*
(*a*)	1575	900	148 0
(*b*)	600	800	140 2
(*c*)	120	300	90 8

The P/S values are found to be (*a*) 1 75, (*b*) 0.75, and (*c*) 0 40 hp /sq ft The corresponding top speeds are plotted against these values in Fig 1. It becomes evident that airplane (*b*) is far superior to the other two, and that airplanes (*a*) and (*c*) are equally inferior, i e. they have the same value of C_D'

It will not be surprising if the reader has formed the idea that such diversity of drag coefficients is not to be

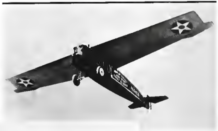
Atlantic XLB-2—P/S = 1 20 hp /sq ft V_{max} = 115.6 m.p.h

found among what are considered highly developed, modern aircraft On the contrary, though the illustration is not as striking as the facts of the case, since *some recently developed commercial airplanes have C_D' values which are between 2.5 and 3 0 times as large as those of existing airplanes of great aerodynamic refinement* Some modern commercial airplanes, in other words, are three times as efficient as some others at high speed.

Fig 2 has been prepared to demonstrate the truth of the preceding statement The spots of this chart represent the airplanes listed in the table "Manufacturers Specifications on American Commercial Airplanes as Compiled by AVIATION," dated December 21, 1929 The lines representing constant values of C_D' correspond to $\eta = 75$ per cent Wing areas and top speeds are from the main table (Section I), the engine powers were taken from the engine table (Section II)

Let it be kept in mind that Fig 2 is based upon manufacturers' specifications and claims The data used in preparing Fig 3 were drawn from F A I records, Army Air Corps flight test results and other well authenticated information Some of the machines represented in Fig 3 are shown here The airplanes chosen for the illustrations are of widely diversified types, the purpose being to show how obviously apparent are the differences of aerodynamic refinement The reader may wonder why a racer has not been included in this group Aside from the fact that their P/S values are so large as to separate them from normal commercial and military machines, the rather surprising reason is that even the Schneider Cup machines of 1927 (reliable data on the latest racers not yet being available) do not exhibit as low C_D' values as those of the "Tiger Moth" or Savoia S-64 This statement is borne out by N A C A Aircraft Circular No 67 in which the value of C_D' for the Supermarine S-5 is estimated as 0 032

THE VERY large range of C_D' values previously mentioned is exhibited by both Figs 2 and 3 It is only fair to point out that the smallest drag coefficients appear in Fig 3 the reader must be warned against being prematurely encouraged by this statement to consider all advertised performance claims as over-conservative, however, as there are few machines represented in Fig 2 which may be reasonably included in the same category with some of the highly specialized examples of Fig 3



Fokker Army T-5—P/S = .426 hp./sq.ft. V_{max} = 106.8 m.p.h.

Consolidated PT-1—P/S = 0 872 hp./sq ft. V_{max} = 92 m p h

Since it has been shown that great variation does exist among the drag coefficients of various types of airplanes —i.e., this diversity is a fact which would be made only more obscure by erroneous advertising—we may now turn our attention to the underlying causes I feel some hesitancy in opening this analysis, for I know that protests may be expected Perhaps the Editor, who, I believe, was one of the first in this country to advance the opinion that too many hairs were being split in the choice of wing profiles, will be add his moral support by a note at this point [Consider it added.—Ed] To proceed then The total drag of an airplane is conventionally divided into induced drag, wing profile drag, and parasite drag We are interested in the relation which exists

between these three quantities when an airplane is at top speed

To get at the induced drag, let us select an aspect ratio (or equivalent aspect ratio, in the case of a biplane) of five as being representative. Most modern airplanes have speed ranges (V_{max}/V_{min}) of 2.25 or more and it is conservative to select 1.4 as the largest probable value for $C_{L\,max}$. These figures lead to an induced drag coefficient $C_{Di} = 0.0049$ for the condition of maximum speed. This is 18 per cent of the total drag coefficient of the most refined airplane represented in Fig 3; it represents but 11 per cent of the total drag of an "average airplane" with $C_D' = 0.045$. The relative importance of the induced drag increases with reduction of the speed range or of the aspect ratio, C_{Di} becoming 0.0097 for an aspect ratio of four and a speed range of two. In the worst case, however, the total drag coefficients of airplanes at top speed will not vary by more than about 0.005, i.e., $0.0097 - 0.0049 = 0.0048$, due to differences of induced drag. This, certainly, accounts for but little of the variation indicated by the charts, i.e., $0.090 > C_D' > 0.027$

What of the wing profile drag, then? (Now the fireworks begin!) The choice of wing profile, among a

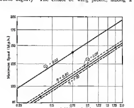


Fig. 1

large number of good airfoils, has a very small effect upon the top speed of an airplane. I find no evidence contrary to this conclusion and apparent verification is abundant. Variable density wind tunnel tests show minimum profile drag coefficients of 0.0080 to 0.0125 if we rule out such impracticable sections as M-1, M-4, U.S.A. 35-A and R.A.F. 19 (N.A.C.A. technical note No. 219, Table IX). The difference between these two coefficients is 0.0045, about equal to the probable variation of the induced drag coefficient. This variation is also relatively small as compared to the difference of C_D' indicated by Figs. 2 and 3. A convincing proof that the choice of profile has a very small influence upon the drag coefficient for top speed is to be found in Fig. 8 of N.A.C.A. Technical Report No. 304; the flight test results illustrated there indicate an increase in C_D' of approximately 0.006 as the result of replacing the R.A.F. 15 profile by the Gottingen 387.

Having eliminated induced and wing profile drags, the "nigger in the woodpile" can only be that familiar old bugbear of the designer, parasite drag. It may be wise to mention at this time that by subdividing the total drag

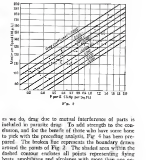


Fig. 2

as we do, drag due to mutual interference of parts is included in parasite drag. To add strength to the conclusion, and for the benefit of those who have some bone to pick with the preceding analysis, Fig. 4 has been prepared. The broken line represents the boundary drawn around the points of Fig. 2. The shaded area within the dashed contour encloses all points representing flying boats, amphibians and airplanes with more than one engine. If the reader will agree that these are types inherently possessed of relatively great parasite drag, the truth of the previous conclusion seems inescapable.

This brings us to a scheme for analyzing and predicting top speeds which hinges upon knowledge of, or rather, the ability to estimate, parasite resistance. A great mass of information on this subject is available in the textbooks on aerodynamics (particularly Diehl, Warner, and Monteith-Carter), in publications of the N.A.C.A. and in Army Air Corps Information Circulars. Some full scale fuselage drag data has recently appeared in N.A.C.A. Technical Reports Numbers 313 and 314. It is advisable, of course, to use full scale test results whenever possible; in this connection, the Air Corps Information Circular No. 629, "Determination of Structural Airplane Drag," is of great assistance as it contains information on the parasite resistance of a large number of airplanes of diversified types.

The critical examination of the top speed claims of manufacturers can not, it is evident, be simplified to the

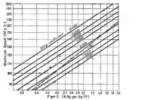


Fig. 3

extent which is possible in the case of landing speeds, i.e., no single "yes or no" test can be applied to the advertised performance. Of course, such absurdities as the claims of manufacturers who advertise performance which requires the attainment of drag coefficients of the same order as those for Schneider Cup machines, in the case of very ordinary designs, are easily detected. In the usual case, however, it is necessary to make an estimate of the parasite resistance in order to pass judgment upon the speed which is claimed.

This fact alone is sufficient to preclude any detailed "sorting" of the figures given in the AVIATION table

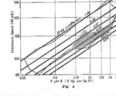


Fig. 4

within reasonable limits of space for a discussion such as this, which is intended to be primarily constructive rather than critical. It is believed that by making use of this form of analysis, designers will be in a position to recognize the true aerodynamic merit of various types and arrangements and that disappointing high speed performance can thereby be avoided. With this in view, although it forms some groundwork for critical examination of advertised performance, the following conclusions are drawn from a study of authenticated flight test data:

1. Cabin airplanes powered with three radial air cooled engines should not be expected to have C_D' values smaller than 0.060 and considerably larger values are common.

2. Flying boats, boat amphibians and twin-engine airplanes usually have

$$C_D' \geqq 0.050$$

3. The best open-cockpit, externally braced biplane which the writer could discover showed $C_D' = 0.034$ (approx.); this is very exceptional as few machines of this type do better than 0.040.

4. One cabin monoplane having a partially exposed radial air-cooled engine has attained C_D' of approximately 0.035; it is conceivable that in this case the value might be reduced to about 0.030 by the use of N.A.C.A. cowling or the substitution of a water-cooled engine. The usual machine of this type will probably have a C_D' value between 0.035 and 0.045.

Although the writer is aware that some advertised top speeds are serious exaggerations of fact, the above conclusions give a much different picture of the situation than that created by a chart which appeared in this magazine not long ago. I refer to Fig. 4 of the article, "Certified Performance Trials and Safety Ratings," by Lieut. Comdr. Frank Wead, which appeared in the issue of December 7, 1929. In this chart (P/S vs. $V_{m.p.h.}$) a curve is faired through a series of points designated "Actual maximum speeds of airplanes obtained by flight tests over measured course" while the great majority of the other points shown (taken from manufacturers' performance claims) are plotted at speeds in excess of those indicated by the curve. The broken line which appears in Fig. 3 of the present paper represents Comdr. Wead's curve. One does not understand why a curve representing such inferior performance should have been presented as a standard of comparison.

The remarkable spread of C_D', of which, I think, not enough notice has been taken until now, has been shown to be largely accounted for by differences of parasite resistance. It is interesting to speculate on the improvement of performance which may be effected in the future by the development of radically different airplane arrangements, or modifications of present ones, which will carry with them important reductions of the proportion of parasite drag. If we go to the extreme and consider the so-called "flying wing," surprising possibilities become apparent. Suppose such a machine, i.e., one with no protuberances external to the contours of a good tapered airfoil, could be devised, a profile drag coefficient of 0.012 might be attained. With complete elimination of parasite resistance, the speed range might well reach a value of four and the induced drag coefficient for top speed would then decrease to about 0.0005. For this case, $C_D' = 0.0125$.

Perhaps the pure flying wing is without the realm of probability; let us then consider the performance of an airplane having a C_D' value which is a mean between the most refined airplane of today ($C_D' = 0.027$) and this ideal value 0.0125—that is, $C_D' = 0.0198$. The V vs. P/S lines corresponding to the ideal and to this

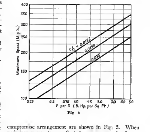


Fig. 5

compromise arrangement are shown in Fig. 5. When such improvements are effected, cruising speeds of over 200 m.p.h. will be possible of attainment with power and wing loadings not exceeding those of present practice.

In conclusion, it seems necessary that attention be concentrated upon the development of practical, retractable landing gears, cargo airplanes without fuselages and cabin airplanes of much improved streamline shapes if we are economically to increase present top speeds.

THE CURTISS-CHICAGO AIRPORT

By James P. Wines

The main flood light is stationed in this brick structure The doors in front of the light are electrically opened and closed

CURTISS-CHICAGO AIRPORT at Glenview, Ill , 22 miles north and west of the Chicago "Loop" district by road, is of more than ordinary interest at this time Aside from the fact that the field embodies a number of new features and is without question one of the finest airports in the country, it has been selected as the site for the 1930 National Air Races, to be held August 23 to September 1, something which is of utmost importance if a greater degree of public acceptance of aviation and the airplane is to be obtained, and which should be of great assistance in making the Air Races this year an unqualified success

It is a large, exceedingly well drained, all-way field, and one that will not become antiquated within a few years While the first hangar unit is the only one to be erected thus far of three required by the building program, this unit is in itself complete with almost every convenience that an airport should possess Aside from this, the unit is remarkable for the provisions made for the comfort of both the spectator and the air passengrr

The port is operated by Chicago Air Terminals, Inc , a subsidiary of Curtiss Airports Corporation Curtiss-Wright Flying Service, Inc., is the chief lessee of hangar space and conducts its local operations there However, it does not hold a monopoly on the use of the field The facilities are available to any organizations leasing hangar space or hangar sites It is true that there has been no great rush on the part of other firms to take space at the port, but the field was opened only last fall

During the race week, the Curtiss organization will "shut up shop," turning the field over to the exclusive use of the Air Race management They will even move to other ports the planes now housed there

A portion of the space inside the hangar unit will be used to store the supplies for the fireworks displays, which will be a nightly attraction There will also be a large cafeteria to handle the enormous crowds that are expected to witness the races this year Although it has not been definitely decided, some of the space may be utilized as an exhibition hall where manufacturers may display types of planes similar to those competing in the race events

Along the entire length of the hangar unit on the field side, a huge grandstand capable of seating 65 000 persons will be constructed, and in front of that on the concrete apron, a number of paddocks where the contesting planes will be displayed before the start of each race The pylon marking the start and finish of the races is to be located on the field at the center of the stand

Two hundred and forty-six acres of land along the northern, western, and southern boundaries of the field have been leased and will be used as parking space Arrangements have been made to have one way traffic on all roads leading to the airport during certain periods of the day By this means, 10 lanes of automobile traffic will be provided It is estimated that the lanes will move at a speed of 8 miles per hour near the field, and from 30,000 to 40,000 spectators can be brought to the entrance in an hour Special trains on the Chicago, Milwaukee, St Paul and Pacific Railroad are being arranged for too, as well as air shuttle services from the lake front near the "Loop" district and the Chicago Municipal Airport

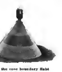
Curtiss-Chicago Airport is in reality two fields, separated from each other by a road The largr one, which contains 320 acres and is lighted, is normally used by planes engaged in all types of commercial activity, except

A detailed description of construction methods employed and equipment installed at one of America's newest and finest air terminals, which is to be the scene of the 1930 National Air Races

The hangar unit and apron taken on the day the airport was dedicated

student training The other field, which is to the south and east, and, incidentally, is known as the "South Field," is for student instruction only None but planes used for that purpose are allowed to land or take off there The field covers 130 acres of ground It is as yet unlighted. While the Air Races are in progress, it will be used for automobile parking It is estimated that 10,000 ears can be parked there

A LITTLE OVER A YEAR AGO the ground now occupied by the two Curtiss fields was farm land It took only half that time to complete the construction work though In that period the ground was leveled, a most complete drainage system was installed, grass was sown, the bangar unit was constructed and a lighting system that is perhaps second to none in the country was placed in operation While bare figures are not always of value in measuring the size of any given task, the number of men and the number and various types of machines employed in building the Curtiss-Chicago Airport may be of interest



One of the cone boundary light installations.

Records of Curtiss Airports Corporation show that 610 men, 360 horses and mules, 101 dump wagons, 14 tractor dump wagons, 5 water wagons, 13 tile wagons, 3 surreys, 60 tractors, 5 tile ditchers 4 excavating cranes, 42 trucks, 10 elevating graders, 8 tractor blades, 2 team blades, 3 tractor plows, 4 tractor double discs, 2 mowers, 3 centrifugal power pumps, 3 concrete mixers, 1 Rex concrete paver and 3 clamshell cranes were employed

The ground was rather uneven ranging from 648 ft above sea level at one point to 630 ft above sea level at another The first job, following a survey of the property, was that of making a grading chart showing the depths of the necessary cuts and fills

The preparation of the grading chart alone was a very neat bit of engineering, although Mr Slapow is frank in admitting that he spent many sleepless nights before it was completed Finally, however, it was decided that by making the field 642 ft. above sea level at the west, with a three-tentha of one per cent slope toward the east, which was satisfactory for drainage purposes, it would not be necessary to bring in any additional material, or to haul away any of the soil that was there In this connection, it is interesting to note that the estimate was so accurate, there was not a cubic foot of earth left over when the field was completed, in spite of the fact that 1,100,000 cu yd were moved in the process

Since the port was to be a grass covered, all-way affair, the first step in the actual construction was that of stripping off the black dirt to a depth of from 6 to 8 in and piling it up in large stock piles, so that it might be redistributed evenly over the surface after the completion of the grading operations Then areas of from 60 to 70 acres were worked over one at a time until the field was smooth and had the desired slope One hundred and twenty acres of very low land to the northeast took a great deal of soil, although the eastern edge of the field is lower than the west, because of the grade

Plans for the airport called for an extensive drainage system, utilizing No 1 vitrified salt glazed tile As the grading of the field was completed, the tile trenches were dug with "Buckeye" trenching machines to which wagons were attached The hook-up was made so that the earth taken from the trenches was loaded automatically into the wagons, which were towed to other parts of the field and dumped

The tile trenches, of course, were not of a uniform depth, since it was necessary to have them sloping toward the mains in order to obtain a natural flow of water The shallowest portions were at the open ends of the 6-in laterals The depth at such points was from 30 to 38 in , in order to place the tile below the frost line. Trenches for the mains, on the other hand, were from 6 to 7 ft deep

THE NORTHERN portion of the larger field is drained by another open ditch This extends north from a culvert under Shemer Road on the west, along Willow Road, which is the northern boundary of the field, and down the river In writing of this ditch, some explanation along the railroad tracks to a 4-ft Armco pipe, which carries the water to the river 2,200 ft. away Some explanation should be made of the irregular course the ditch follows northwest of the field As a matter of fact,

the ditch is in part a creek, which was diverted by the airport engineers in the construction of the field, and the irregularity at the corner is intentional. That portion of the field, where there are now several farm buildings, eventually will be occupied by a flying club, and the creek is to play an important part in the landscaping program

THE CENTRAL, and by far the major portion, of the North Field is drained by a complete underground system, just as is a large part of the one used for student training However, because the area drained is much larger, the main is formed first of 18-in tile, then two rows of 24-in tile, and finally of three rows of 24-in. tile These lines empty into the open ditch about 100 ft north of the mouth of the pipe

The various sizes of tile used in the drainage system are 6, 12, 15, 18 and 24-in., depending, naturally, upon the estimated rate of flow In all, 374,105 lineal feet of tiling were laid, or a total of nearly 71 miles. Incidentally, it is of interest to note that at all joints where two lines come together at an angle, especially constructed "Y's" were employed The joints are curved instead of being of the usual angular variety. All elbows are likewise curved

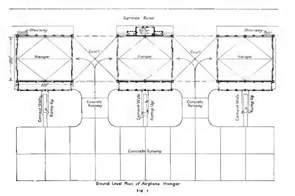
As the tiling was laid, the trenches were backfilled with pea gravel, a cubic yard of gravel covering 13 lineal feet of tile on the average. Dirt was then added to complete the backfilling operation; and the black surface soil, which was stripped originally, was replaced.

When the entire airport was completed to that extent, the surface was rolled and 60,000 lb of mixed grass seed were sown. The mixture consisted of 20 per cent each of Canadian rye, Kentucky blue, hard fescue, German fescue and white clover, which, it is said, will produce a very tough turf The grass itself grows to a height of about six inches at maturity, but lies flat along the surface of the ground, forming a protective mat, so that there is little danger of the turf's being torn up by the tail skids of the planes using the field.

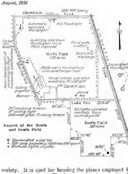
Grass was selected for the Curtiss airport, because officials of the Flying Service wanted as dustless a port as possible They also wanted an all-way field, so that planes could land and take off anywhere, since they felt that with the increasing volume of air traffic runways will soon become obsolete.

In commenting upon this situation, Mr. Slepow advanced the theory that a field constructed after the manner of Curtiss-Chicago Airport should not be used for a period of a year after completion He pointed out that that length of time would be sufficient to allow the development of a good turf; and, also, that there is a 17 per cent settlement in loose soil. However, it was found necessary to fill only about 200 lineal ft along the tile lines this spring To provide a good turf, the field was entirely replanted this year Approximately 200 lb of grass seed to the acre was sown, while almost three times that amount of fertilizer was applied. It should be in excellent condition at the time of the races

WHILE the work of preparing the landing areas was being carried to completion, construction of the first hangar unit at the southwest corner of the commercial field likewise was going forward as was the erection of a sheet metal hangar on the student field The latter can be dispensed with in short order, since the structure, which is 110 ft square, is of the ordinary



Ground Level Plan of Airplane Hangar
Fig 1



Layout of the North and South Field

variety. It is used for housing the planes employed for student instruction The hangar unit, however, is far from the ordinary It was designed by A. N. Rebori of Rebori, Wentworth, Dewey and McCormick, Inc, a Chicago architectural firm, and embodies a number of unique features suggested by Maj. R. W. Schroeder, vice-president and general manager of Curtiss-Wright Flying Service and Chicago Air Terminals, Inc

The main structures about which the unit is built, are the brick hangars. There are three of them, each measuring 120 ft. in length and 102 ft in width Between these hangars are concrete courts, not quite as long but approximately as wide, as shown in Fig 1 A single sheet metal roof, insulated with a 2-in layer of pulverized limestone and supported by steel trusses covers both the hangars and the courts The hangars themselves are open at both ends, but may be closed off with the sectional steel Truscon doors that have been provided These doors operate on tracks

On the field side and on the hangar sides of the courts, there is a single track for the doors At the back of the courts, however, there is a double track As a result of this arrangement, several combinations may be effected If it is desired to close off the hangars separately, the doors may be pushed into position so that they cover the ends, leaving the roofed but otherwise open courts between If it is necessary to have one large hangar, the doors may be arranged to close the ends of the courts On the other hand, two of the hangars can be made into one by the same system, while the third can be closed off separately The double track at the back of the courts, of course, makes it possible to slide one set of doors over another, leaving the front of the courts and the ends of the hangars open.

The convenience of being able to change three hangars into four or five at any time, may be seen at a glance, but the system is also advantageous from the standpoint of economy Take, for example, the heating of the hangars during the winter months If there are too few planes to fill the entire unit, they may be pushed into one part, so that it will be necessary to heat only that space. A unit heating system, with the heaters set in the walls, is employed with this in view

Along the field side of each of the three hangars, there is a 20x20 ft "lean-to" These structures are used to house the Curtiss supply depot, overhaul shops and offices The roof of each one forms the floor of a gallery where the air passenger waits until it is time for him to board his plane This keeps him off the field and out of the way In addition, he is high enough so that he does not suffer the annoyance of getting into the wash of a propeller, and he is in a position where he can see more than he could if he were standing on the field For loading purposes, there are long ramps from each gallery to the concrete apron in front of the hangars This apron is 680 ft long and 120 ft wide, and is joined to the paved courts by concrete strips 60 ft wide

The roof of the passenger galleries is formed by an observation deck of cantilever construction, extending from one end of the hangar unit to the other Like the passenger galleries, it is 20 ft wide. Since the upper deck is intended for the use of spectators, the hangar roof, instead of completely covering it, is cut back 10 ft. This affords those making use of it the opportunity of watching planes in the air without too much inconvenience

It might seem that the placing of the observation deck across the open courts as well as in front of the hangars would limit the height of the planes that may be taken inside. However, there is no difficulty in this regard as

Fig 2

the clearance under the deck is 20 ft., the same amount that there is throughout the unit.

THE FIELD side of the hangars, of course, forms a back wall for the passenger galleries and the observation deck This wall however, is not of solid brick as might be expected It is known that large windows are advantageous in any structure where men are employed, so that as much daylight as possible may be admitted With

that in view, the back wall of the galleries is practically all window space. However, instead of employing one of the translucent varieties the glass is clear with the result that the passengers and spectators may look down into the hangars and see the mechanics working on the planes This certainly is a decided innovation It has been held, heretofore, that it is poor psychology to allow the passengers to see even minor repairs being effected on a plane in which they are about to take off Major Schroeder's theory, on the other hand is that the arrangement should inspire added confidence, since it makes it possible for the passengers to see the great care with which the planes are prepared for flight The outcome should be interesting

When the building program for the Curtiss-Chicago Airport is completed, there will be another unit built to the same plans as the present one in a corresponding position along the south side of the field Between and adjoining these two structures, there will be an L-shaped administration building, housing the offices, the display rooms of Curtiss-Wright Flying Service a restaurant and a waiting room for passengers All planes utilizing the field will load and unload their passengers at the administration building

The control tower, which now surmounts the center hangar of the first unit will be moved to the central structure; and the passenger galleries will be glassed in and turned over for the use of pilots and mechanics The observation deck will be retained as an observation deck, but it will measure 2,000 ft. in length instead of 576 ft. as at present Behind each hangar, there will be a garage, a parking space, shops, classrooms and students' dormitories The proposed layout is shown in Fig 2 It will be seen that the plans include the construction of a hotel Thus and the administration building are to be erected as soon as possible.

The lighting system of the port on the hangar is operated entirely from the central control station, just as is the loudspeaker system that has been installed.

Later when the tower is moved to the administration building, the servicing of planes with gas and oil will be controlled from that point also

At present, the lighting system of the field includes 39 special Sperry 1,000 w floodlights for the illumination of the hangar unit, an 18-in ceiling projector; a 25,000,000 cp revolving beacon with a 24-in reflector; 6 General Electric kettle drum 1,000 w floods to light the parking space; boundary lights of the cone-shaped variety; obstruction lights on all poles and trees near the field and on the radio towers of station WBBM across Shemer Road; an illuminated wind tee, and three main floodlights

Although much of the lighting equipment in use at the Curtiss field is of special design, the floodlights are by far the most interesting The main light is a 180-deg spread Sperry high intensity floodlight type AGA. It is of the 1 000-mm size, and was manufactured for Curtiss Airports Corporation at a cost of $7,500 The grinding and polishing of the lens, which was done in Sweden alone required the services of 15 men for a period of three months As a result of the excellent grinding job, however, as well as the fine optical glass used there is said to be no glare when the light is in operation

The floodlight is mounted in a brick structure, which was designed by Mr Rebori and is in keeping from an architectural standpoint with the hangar unit. Besides the light the structure contains a 30-hp motor generator unit which supplies the current There is likewise an automatic switching panel that turns on the other two lights if the arc in the large one fails to function. Another feature is that a bell rings in the control tower when the carbons in the light reach a point where there is likelihood of their burning out

The two smaller lights, mentioned in the last paragraph are in reality auxiliaries They are both 500 mm incandescent floodlights of three kilowatt capacity One is mounted alongside the main floodlight unit at the north, while the other is located at the south end of the field These lights are used only in case the larger one should fail.

From the description of the field itself, the hangar unit and the lighting system, it will be seen that the Curtiss organization has spared no expense in its attempt to make the Curtiss-Chicago Airport one of the finest in the country Although the actual cost of the project has not been revealed, it is known that the purchase price of the land was $680,000, the cost of the drainage system was $690,000, and other things in proportion

A view of the service department in the hangar. Note the windows by the balconies.

Shop Notes and Technical Data

RESULTS OF RESEARCH IN STAINLESS STEEL

By Col. E. J. W. Ragsdale
Edward G Budd Mfg Co

THE Edward G Budd Manufacturing Company of Philadelphia, which has long been identified as the originators of the all-steel automobile body, has decided to extend its activities into the aviation field. Following the decision to confine its efforts entirely to structures, the research engineers inaugurated a study of stainless-steel strips, electrically spot-welded together to form closed sections. The reasons for this decision were

1—Stainless-steel is capable of being worked to high physical properties without heat treatment It is exceptionally uniform in behavior, now or ten years from now. It's very nature makes for ideal welding conditions With strip, there is no scrap

2—Electric spot welding seems preferable to riveting or gas-welding A hundred rivets an hour constitutes good practice for two men One man, with the new welder designed by the Budd Company, can make over a hundred spot welds in a minute Gas-welding is tedious, involves intense local heating and required the services of an expert It takes six months to train good gas-welders; the spot-welders start on piece work after a day and a half

With these initial premises fixed, the Budd laboratories proceeded to design and test certain basic structures Structural work was later stopped to complete a thorough study of welding It was realized that absolute uniformity of welds must result How successfully this has been done is evidenced by the statement that no test specimen has yet suffered a failure attributable directly or indirectly to the welding

In resistance welding, a number of variables control, pressure and diameter of the electrodes, voltage, amperage and time primarily These admit of an almost infinite number of combinations Considerable work resulted before they were brought into proper relation and all control removed from the hands of the operator Incidental to this work, an electric "sewing machine" evolved While primarily intended for research its adaptation to production presents little difficulty

The determination of a proper material for electrodes constituted another broad study Some materials are too soft and wear out, others flake or burn the weld Plating of the points, so far, has proven to be only of temporary value

In connection with the basic work on welding, the Budd Company has appreciated that no satisfactory use of its findings can result unless structures are designed to favor welding conditions This means the provision of suitable and accessible welding surfaces It means that these surfaces should be preferably along the neutral axis It means that an adequate number of welds be provided to take in shear every force imposed How these principals have been translated into practice is best illustrated by the accompanying view

The longeron member consists of two sections—an inner and an outer To the first are attached the diagonals, then the inner and outer gussets Finally both longerons and diagonals are closed by flange welding

Fabrication by this methods opens up another possibility, and that is local reenforcing at critical stations Curved longerons, for instance, are strengthened by welding angle sections to the concaved center-portion

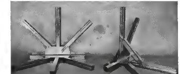
A saving in weight over conventional tubular construction results, as is also the case where tube gage becomes governed by gas-welding or corrosion rather than expected stresses

The use of thin gage, non-corrosive steel and electric spot-welding invites designs of girder-type constructions such as would, otherwise, be prohibitive A built-up column 61 in long and weighing 3½ lb was tested It collapsed under an end load of 15,000 lb., but the significant fact is that after 14,000 lb had been applied and released there was no measurable distortion of the structure

Stainless steel is a broad term covering a variety of products The Budd Company, with the cooperation of the Allegheny Steel Company, has worked out the specifications for a material best suited to its needs It is known as "18 and 8," since it contains 18 per cent chromium and eight per cent nickel The processing, however, is more significant than the mere composition, for a resulting tensile of 200,000 lb per sq in is required This comes from extreme cold-working and, yet, the material must have a remaining toughness ductility and workability to make it suitable for die or other forming operation In gages up to 016 in, the strip will take a "Dutch Bend" either across or along the grain

Initial rusting of spot welds is apt to appear after a few hours in the salt spray This does not progress, as it is purely a surface condition, due to a microscopic flash and can be removed by washing with dilute nitric acid An official government test of 1,100 hours salt-spray has, so far, failed to indicate other than the initial discoloration of the welds

Relative to fatigue, less data are available, though such as are indicate a ratio comparable to the best alloy steels Tests of completed or partial structures will



Truss construction of stainless steel strips

alone be determining and these are in progress. One test relates to a strip of stainless steel five eighths of an inch wide and 012 in thick To the center of this, a patch is secured by three spot-welds whose aggregate diameters equal one-half the width of the strip The patch, in itself, contributes no additional strength, it affords merely a means for simulating a welding condition The strip so treated pulls 1,450 lb against 1,600 lb for a similar piece untreated. The welded material has, therefore, caused a loss in strength of some ten per cent. A drop test confirms this

No material seems without its draw-back, but those of stainless steel are not to be found in the physico-chemical realm so much as in that of fabrication. In the severely cold-worked condition, it is about the meanest stuff to handle that ever was introduced into a press shop The spring back is terrific; the hard, mirror-like surface defies clamps and it is hard on tools of every kind Hand or power brakes bend up curves on straight dies and draw bench work is even less happy So far, the best results have been had with draw-rolling When the rolls are driven, "cobbles" are more apt to issue

With it all, stainless strip steel seems to offer many worthwhile advantages. With the development of fabrication by welding, and with a price reduction which the trade already sees indicated, stainless steel should bring about a change of design philosophy

ALUMINUM FORGINGS AND CASTINGS APPLIED TO AIRCRAFT

By Douglas B. Hobbs
Aluminum Co of America

SEVERAL decades ago the commercial history of aluminum began The non-toxic qualities of the metal, its lightness and its heat conductivity soon became apparent and strongly recommended the use of aluminum for cooking utensils This light metal is still a household necessity but it is no longer content to be classed in this category alone Since the early days, when aluminum was used only for cooking utensils, alloys have been developed with inherent characteristics that make their use far more extensive All branches of transportation have recognized in aluminum, and especially in its strong alloys, materials with which to accomplish the necessary weight reduction without jeopardizing strength and safety Possibly in no other field is the advantage of light weight so beneficial as in aircraft yet aviation demands a material which is not only light but strong and enduring Aluminum in alloy form combines these three requisites.

The alloys of aluminum may be divided into two classes—the wrought alloys and the casting alloys The first group of alloys may be fabricated into sheet, plate, foil, bar, rod, wire seamless tubing and pipe molding structural shapes—both extruded and rolled rivets, stampings and forgings, while the second type may be cast either in sand, dies or permanent molds.

Some of the wrought products of aluminum used in aircraft construction are made from commercially pure aluminum or from the aluminum-manganese alloy containing 1 25 per cent manganese. However the majority are produced from the duralumin type of alloys, commonly referred to as "dural." The mechanical properties of the principal duralumin type alloys are shown in table I For forgings 25S and 51S are most commonly employed but the other wrought products all of the high strength alloys are used.

The physical properties of the sand casting alloys which are most generally used in aircraft work are given in Table II. Many of these alloys are also cast in permanent molds When this is the case, the physical properties are higher because permanent mold castings solidify much quicker and have a finer grain structure than sand castings At times some of the castings alloys, and especially those which can be heat treated are referred to as "dural castings." This, however, is an incorrect use of the term "dural" since the duralumin type of alloys are produced only in wrought form

Aluminum castings and forgings are extensively used in the fabrication of all of the present-day aircraft engines. The crank case is generally cast from the heat treated 195 alloy. Occasionally 145 or one of the three 8 per cent copper alloys is used Two of the outstanding radial engines, however, have employed forged strong aluminum alloy crank cases and nose pieces for a long time with marked success A number of years ago the forging of an aluminum crank case would have been considered an engineering impossibility, and the development of the proper forging technique for such an undertaking represents a marked advancement in the art.

The lightness and excellent thermal-conductivity of 122 and 142 (Y) alloys generally dictate their use for cylinder heads These alloys are also chosen because of their ability to retain, at elevated temperatures, a larger portion of their strength than is possible in the other alloys Water jackets and valve housings for in-line motors are frequently cast in 195 or 142 alloy

The pistons of practically all of the aeroplane motors now in use are of aluminum alloys They are generally cast from 122, 132 or 142 alloy. Both 122 and 142 alloys have been employed in pistons for some time. Alloy 132 is a recent development and possesses properties which should make it particularly attractive for aircraft-engine pistons. Its advantages consist chiefly in a lower coefficient of expansion and in a specific gravity of 2.7, which is almost identical with that of pure aluminum. The lower coefficient of expansion makes it possible to fit the pistons with less clearance than is required in either 122 or 142 alloy, and the lower specific gravity reduces the reciprocating weight and allows for a reduction in the weight of the crankshaft since smaller counter balances are required Alloy 132 is rather difficult to cut, but with cemented-tungsten carbide tools it can be machined even more readily than the standard piston alloys with standard tools

In many instances the link rods of radial engines and the connecting rods of in-line engines are forged from the strong aluminum alloy 25S. This alloy in the fully heat-treated condition can be used as a bearing material running directly against the journal, provided the latter is hard enough and the loads are not too great It seems to be entirely practical, for instance, to operate the material directly against a nitralloy piston-pin or knuckle-pin.

Other uses for aluminum castings and forgings in aeroplane engines include rocker boxes and covers, impellers, intake manifolds, bearing caps, magneto housings and gears, castings for the oil and fuel pumps, carburetor and supercharger and many miscellaneous smaller parts and levers.

The majority of aircraft to-day have light alloy propellers. These are forged and heat treated to give a minimum tensile strength of 55,000 lb. per sq in. Besides being strong and capable of withstanding rain and sleet storms, they possess another characteristic which is of outstanding importance Often in making a forced landing, the propeller strikes an obstruction, if the blade is made of wood it is immediately splintered, but if forged from an aluminum alloy merely bent. The same is true while the ship is in flight, an obstacle in the air that would splinter a wooden propeller will probably only bend an aluminum blade The aluminum propeller may be badly distorted, but it is possible for the manufacturer to re-straighten and refinish it. It is not an uncommon occurrence for a pilot, who has bent his propeller in an accidental or forced landing far away from his airdrome, to straighten the blades out the best way he can and fly the ship to the airdrome There the temporarily straightened blade can be removed and forwarded to the manufacturer for permanent repairs

While in the wings and fuselage there is a broad application of aluminum sheet and tubing, there are many uses for castings and forgings Various fittings for the wing spars, interplane struts and fuselage are commonly produced as aluminum castings usually in the high strength 195 alloy, as are parts for the control board and mechanism Heat treated sand casting alloys are also employed for such parts as the oleo wheels spring casings, brake shoes, landing gear fittings and pontoon nose pieces Some of the above parts as well as the aileron horns, control stick and fulcrum are frequently forged

The size and shape of a part and the physical properties desired in it, largely dictate the manner in which it is made A great many parts now produced as castings might easily be forged, while others might be fabricated in this manner with a few minor changes in design A forging is, of course, stronger and while the casting may be of sufficient strength for the service it is to perform a forging provides an added factor of safety. The greater strength of the forging may be utilized in further weight reductions by decreasing section thickness Because of the small production of planes and the frequent changes in design, forgings were not widely used in the early days of aviation. But to-day with an increase in the number of planes and a greater stability in design, there is a much broader application.

The increased use of castings and forgings in aeronautics has necessitated a satisfactory means for internal inspection Possibly in no other branch of transportation is the need for structurally sound members as imperative as in aircraft since the failure of any one part might cause the loss of life. In order to find hidden defects such as blow holes, porosity, shrinks and cracks and insure the soundness of its castings and forgings the Aluminum Company of America has installed x-ray equipment in two of its plants The x-ray not only serves for routine inspection work but is important in the foundry.

Table 1

Alloy	Approximate Yield Point Lb per Sq In	Tensile Strength Lb per Sq In	Elongation Per Cent in 2 in	Brinell Hardness 1000 Kg Load 10 mm Ball
195-4	13,500	28,000—36 000	6 0—12 0	58—70
195-6	21,000	30,000—40,000	3 0—8 0	70—95
195-10	22,000	36 000—50 000	0 0—5 0	80—110
122	18 000	18 000—23,000	1 0—9 0	55—75
112	16,000	19 000—24 000	1 0—2 5	60—80
212	18,000	19 000—24,000	1 0—2 5	65—80
122-T	20 000	25 000—43 000	0 0—1 0	100—125
109	15 000	20 000—28 000	0 0—1 5	68—85
43	7 000	17 000—22,000	3 0—7 0	35—55
47 (modified)	10,000	24 000—31 000	5 0—15 0	45—55
145	12,000	25 000—37 000	3 0—6 0	55—70
142 (Y alloy)	25 000	30,000—40 000	0 0—2 0	90—135

Notes 1 If the alloy is heat treated, the heat treat number follows the alloy number as in 195 4

2. The Aluminum Company of America owns patents relating to 122, 142 195 and 196 alloys and the heat treatment processes used in connection therewith, as well as patents relating to 145 alloy and the modification of 47 alloy

Table 2

Alloy	Tensile Strength (Lb per Sq In)	Yield Point (Lb per Sq In)	Elongation (Per Cent in 2 in)	Brinell Hardness (500 Kg Load) (10 mm Ball)
51st	40 000—50 000	30 000—40 000	12—18	90—100
25st	55,000—63 000	30 000—40 000	16—25	100—120
17st	55 000—63,000	30 000—40 000	18—25	90—105

Notes 1. The properties given in this table are for forgings in the fully heat treated and aged condition. Other wrought products have approximately the same range of physical properties.

2. The Aluminum Company of America owns patents relating to 25S and 51S alloys and the heat treatment processes used in connection therewith

DETERMINATION OF TIMED HIGH SPEEDS

By Harry A. Sutton
The Aviation Corporation

THE timed high speed of an airplane in level flight is generally more easily determined than any other performance characteristic since the test requires little preparation and the necessary calculations are quite simple. A straight, level and known distance, preferably at least two miles in length and free from obstruction to low flying, over either water or land and a stop watch are the only special facilities necessary. The time of flight for several trips over the course in opposite directions is measured and the speed is calculated from these times and the known distance Since the time is usually measured in seconds and the length of the course in feet, the reduction to miles per hour is accomplished as follows:

Length of speed course $= L$, ft.

Time over course in one direction $= T_1$ sec.

Corresponding velocity $= V = \frac{L}{T_1}$ ft./sec.

or in miles per hour, $V_1 = \frac{3600\,L}{5,280\,T_1}$

and if $C = \frac{3600\,L}{5,280}$, $V_1 = \frac{C}{T_1}$ m.p.h.

The timed speed in one direction is thus determined by simple division. The speed in the opposite direction will differ due to effect of the wind which generally blows wherever a high speed test is to be made. The effect of a wind blowing parallel to the speed course can be eliminated by averaging the *speeds* determined by flying over the course in opposite directions It seems fairly obvious that the speeds in opposite directions should be averaged to

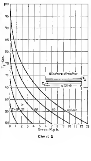


Chart 1

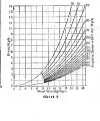


Chart 2

eliminate the effect of wind However, I have observed that a number of pilots and some few engineers believe they are making the proper correction by averaging the times of flight over the course in opposite directions and computing the speed from this average time. A little reflection will illustrate the fallacy of averaging times of flight instead of speeds The wind will change the ground speed by an amount equal to its velocity, increasing the ground speed on the down wind trip and reducing it on the up wind trip. Obviously the time of flight will be shortened on the down wind trip and lengthened on the upwind trip. The wind will thus be assisting the ground speed of the airplane over a shorter period of time than it will be retarding its ground speed Herein lies the reason for the error introduced by averaging time instead of speeds If we assume that an airplane having a speed of 100 m.p h. in still air is flown East over a course two miles in length into an East wind of 10 m p h. velocity and is flown back over the course, the wind will retard the airplane when flying East and assist it when flying West and the respective ground speeds will be 90 m.p h. and 110 m.p h. The trip will require $2 \times 3600/90 = 80$ sec from West to East and $2 \times 3600/110 = 65.45$ sec. from East to West The average time is 72.72 sec and the speed corresponding to this time is $2 \times 3600/72.72 = 99.01$ m.p.h or 0.99 m.p h, approximately 1 per cent low.

In order to illustrate the variation of the error caused by averaging times instead of speeds the formula derived below may be used

The error is found to vary directly with the square of the difference in times and inversely with the product of the sum of the times by the product of the times. It is therefore high in case of a strong wind and a slow airplane and low in case of a mild wind and a fast airplane. The curves of Figures 1 and 2 show the error for a particular set of conditions These curves have been extended to higher wind velocities than permissible in satisfactory testing in order to illustrate the manner in which the error varies

Time from West to East	$= T_1$ sec.
Time from East to West	$= T_2$ sec.
Speed from West to East	$= V_1$ m.p.h.
Time from East to West	$= T_2$ sec.
Speed from East to West	$= V_2$ m.p.h.
Speed in still air	$= V$ m.p.h.

Correct method of determining speed

$$V_1 = \frac{C}{T_1}$$

$$V_2 = C/T_2$$

$$V = \tfrac{1}{2}\left(\frac{C}{T_1} + \frac{C}{T_2}\right) = \frac{C}{2}\left(\frac{T_1 + T_2}{T_1 T_2}\right)$$

Incorrect method

$$\text{Average time} = (T_1 + T_2)/2$$

$$V = C/\left(\frac{T_1 + T_2}{2}\right) = 2C/(T_1 + T_2)$$

$$\text{Error} = \frac{C}{2}\left(\frac{T_1 + T_2}{T_1 T_2}\right) - \frac{2C}{T_1 + T_2} = \frac{C}{2}\frac{(T_1 - T_2)^2}{T_1 T_2 (T_1 + T_2)}$$

Of course, there are many other important considerations in determining the high speed performance of an airplane and for accurate comparative purposes the standard sea level high speed should be determined However, timed high speeds are very useful if properly determined and intelligently used. The one error noted above is easily avoided or corrected and, since correction results in giving the airplane a higher speed rating no difficulty should be encountered in insuring use of the proper method of computation

A NEW PASSENGER CHUTE FOR TRANSPORT PLANES

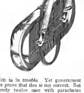
By George Waite
President, Irving Air Chute Co., Inc.

THE PARACHUTE, as originally designed, was intended for use in the planes then most in use—open cockpit planes, easy of entrance and exit The rapid introduction of cabin planes during the last two or three years brought other problems, with the result that the majority of passenger carrying in cabin planes has been done without the use of the added safety factor of the parachute There have been many reasons for this

It is interesting to note that the civilian uses the parachute just as successfully as does the professional pilot. This may be proven by our figures showing the classification of saves to lives saved.

There is the argument that it takes too much time to leave a cabin plane which is in trouble Yet government tests prove that this is not correct. But recently twelve men with parachutes left a cabin plane in ten seconds

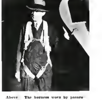
It was with all adverse arguments in mind that we began to develop a type of air chute, about two years ago, which would be particularly useful in cabin planes Our quick connector air chute, recently introduced, is the result of this experimentation.



In this new air chute for use in closed planes, the parachute pack is not worn at all times by the person in the air as is the case with other types of parachutes The harness is worn as usual but this in no way interferes with the freedom of movement of the wearer as does the pack This harness does not differ essentially from the usual Irvin Air Chute harness, either in material or design, except that, suspended from the shoulders of the wearer in front to a line slightly above the waist, are two safety hooks or snaps

Upon the parachute pack are two small metal bars about an inch and a half long, spaced the same distance apart as the snaps hanging upon the harness. These are really rectangles of metal which project through the pack Upon the inside of the pack the corresponding opposite side of the metal rectangle to that on the outside of the pack serves as the terminal for the shroud lines.

Each of the four edges of the canvas pack exterior is fitted with a canvas handle which is made so that it projects out from it. It can be carried or handled by any one of them. The parachute pack is carried in a receptacle or upon hooks on the inside of the plane and at



Above The harness worn by passengers and left the Irvin chute with snaps in place Note the canvas handles on all four sides

the side, or within arm's reach, of the person who may, in emergency, wish to attach it With two natural movements of his arms he may reach for it and pull it back against his breast so that the two metal bars click into the two safety snaps Once in, they cannot be removed from these snaps unless the thumb is applied to the safety catch which is held in place by a light spring

The shroud lines in this new quick connector type of chute are continuous From one rectangle they extend to the chute over the chute, down the other

side to the opposite metal rectangle and then to the first one

In riding down the harness will feel a bit more agreeable if both snaps connect with the metal rectangles but the safety factor is just as great and the chute will open just as quickly if but one snap makes the connection This new quick connector chute has been put through exhaustive tests over a period of several months, both with live jumps and with dummies The results have justified all expectations Independent tests have been made by the British Air Ministry so that the latter has already adopted the parachute and is using it for certain phases of its activities

Perhaps the most interesting independent tests were made by the well known Deutsche Versuchsanstalt fur Luftfahrt e. v, at Berlin-Aldershof. Two sets of tests were made, one of which was with both snaps attached to the rings, and the other set with only one snap attached to one ring, in the latter tests the same ring each time. After each one of these seven tests the D. V. L officials approved the chute without qualification

New Equipment

LOW WING METAL TRANSPORT

THE new Prudden-Whitehead all-metal monoplane embodies many new features While the unusual features to be noted in the construction can in no way be considered radical, it is in their application, and the design that has created favorable impressions during this plane's recent demonstrations in the East

The plane, the product of Atlanta Aircraft Corp., located at Atlanta, Georgia, is of duralumin and Alclad construction throughout and is of the low-wing type It is powered by three Wright J 6-R760 engines The fuselage is of full monocoque types, the bulkheads being formed from sheet duralumin, over which the corrugated Alclad skin is placed

The monoplane wing is of full cantilever construction, carrying three main spars of duralumin, with Alclad covering The corrugated metal wing covering carries a portion of the stresses

Possibly the most notable feature of the plane is the installation of the outboard engines in the leading edge of the wing, carrying a modified N A C A cowling, with collector ring in the leading edge The landing gear is of conventional split type, with an Aerol shock strut installation on the main wheels and an Oildraulic strut at the tail wheel Bendix brakes, with high pressure tires are standard equipment

Ailerons are inset, and the tail surfaces conventional, with balanced rudder In the appointments of the passenger cabin, every consideration has been given the comfort and safety of passengers Ventilation is furnished by specially constructed, adjustable ventilators at each seat the plate glass windows being fixed. The pilot's cockpit windows carry shatterproof glass, two of which are movable A broad range of visibility is to be had not only from the pilot's seat, but from the cabin, as well Seats are upholstered in leather

Details which may promote safety have been carefully worked out in the design of the plane, and in the construction as well

The engine installation is made up of three separate units in order that any operating failures can affect no more than one engine at a time Fuel, baggage compartment and all weighty constructions are placed below the passenger cabin It is interesting to note the considerable load space, available without the use of the passenger compartment for this purpose The plane now produced seats eight people and is designed for transport use

Span overall	66 ft. 6 in
Length overall	44 ft. 10 in
Height	14 ft. 3 in
Wing area	662.5 sq.ft.
Wheel tread	18 ft. 6 in
Net weight	5,200 lb
Useful load	2,535 lb
Gross weight	7,735 lb
Pay load	1,330 lb
Engine (3 Wright J6-R760-245 Hp.)	735 hp.
Wing loading	12.25 lb per sq ft.
Power loading—3 engines	10.75 lb hp
Power loading—2 engines	16.1 lb hp

TWO NEW FORD MONOPLANES

SIGNIFICANT in the development of modern aircraft and their power plants is the all-metal Ford tri-engined transport plane, powered with three Packard Diesel radial air-cooled engines The new Diesel engines, which hereafter will be optional equipment on the Ford 4-AT transports, are rated at 225 hp, giving a total of 675 hp.

The Diesel-powered Ford transport

Above: The Ford 4-AT all-metal transport powered with Packard Diesel engines

At left The Prudden Whitehead low wing monoplane, built by the Atlanta Aircraft Corp

has been of much interest to transport operators and pilots due to the possibilities of effecting economies in air line operations through the use of planes of this type

The Ford 4-AT transport, powered with the diesel engines, carries nine to eleven passengers. The span is 74 ft, the length 49 ft. 10 in, and the height 12 ft 8 in. The wing area is 785 sq ft and the landing gear tread is 16 ft 9 in.

The weight of the plane empty is 6,500 lb, the useful load 3,630 lb and the pay load 1,774 lb. The total weight of the plane loaded is 10,130 lb. Fully loaded, the wing loading is 12.9 lb per sq ft., while the power loading is 15 lb per hp with three engines and 22.5 lb per hp with two engines. Like other Ford passenger transports, the plane is equipped with baggage space and with a toilet compartment.

A de luxe club plane equipped with berth, lounge chairs, davenport, kitchenette, writing desk, loud speaker radio and other conveniences of the club or yacht is also being offered as a standard model by the Ford company.

The club plane is the regular 5-AT Ford tri-engined plane using three Pratt and Whitney Wasp engines, especially equipped for the owner who wishes to entertain his guests in the air. Instead of the usual seats for passengers the cabin has been arranged to seat nine persons comfortably and to provide the club features

The cabin is trimmed in cloth. Seven special reclining overstuffed chairs and a well appointed two-place davenport are attractively placed

In the ceiling just above the daven port, is a folding standard size berth. This is arranged to fold out of the way as in a Pullman car.

Forward in the cabin is a combination writing desk, radio cabinet and book case finished in attractive black walnut. The radio set is concealed in a compartment in the rear of the plane with the dials built into the desk.

Windows are of the single plate style and do not open. This construction helps to minimize noise and makes possible a better control of ventilation. A ventilator is built into the side of the cabin in front of each window, and the passenger can regulate the intake of air. There is a large outlet ventilator in the ceiling of the forward part of the cabin.

Heat is supplied to the cabin by small registers in the aisle. Lighting is furnished by dome lights and diamond shaped side lights on the walls directly above the passenger chairs.

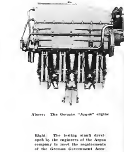
One of the most interesting features of the plane is the kitchenette situated just opposite the entrance door and partitioned off from the rest of the cabin. A combination aluminum sink, drainboard and hot plate with shelf and closet space above and below provides the working place for the chef. Water is supplied from an overhead tank. The hot plate is heated by Pyrofax carried in a tank concealed in a small cabinet. Small round windows furnish light to the compartment. There also are a small dome light ventilator and electric fan

A GERMAN LIGHT ENGINE

THE Argus Engine Works one of Germany's oldest aero engine manufacturers now controlled by the Horch Automobile Company, has re entered the aircraft field with a new four cylinder inverted engine which delivers 80 hp at 1,400 r.p.m. The designer is Dr Franz Dindage. The low number of r.p.m., at which the engine is operated, aims at increasing the reliability and life of the engine while reducing maintenance costs and with the further object of obtaining a good propeller efficiency. The general specifications are

Bore	4.73 in.
Stroke	5.51 in.
Cylinder capacity	336 cu in
Compression ratio	1:5.3
Length overall	42 in
Maximum breadth	16.5 in
Maximum height	35 in
Weight	248 lb
Fuel oil consumption	.6 pt per hp hr
Lubrication oil	.016 pt. per hp.hr

The 80 hp Argus engine was the first to pass the new increased requirements of the German Government Aeronautical Experimental Institute. Out of 93 hr test on the stand, 18 hr were on a new turnable stand, to ascertain that



Above: The German "Argus" engine

Right: The tesling stand developed by the engineers of the Argus company to meet the requirements of the German Government Aeronautical Experimental Institute. The stand revolves at 24 r.p.m

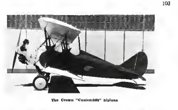
the crankshaft could stand 1.5 million load changes with the square load increased 100 times. The turntable test stand revolved at 24 r.p.m. which corresponds to exposing the engine to an angular speed of 360 deg. in 5 sec.

Previously the engine had been tested with an overload and at a number of r.p.m. beyond the maximum. The engine was also subjected to running throttled and full out while mounted 35 deg. inclined upward and downwards. A flying time of 72 hr. in a B.F.W. (Bavarian Aircraft Works) Flamingo biplane concluded the tests. This slow aircraft, which attains a speed of 75 m.p.h., was chosen in order to test the cooling efficiency of the engine under difficult conditions.

The crankcase is an Electron casting divided above the crankshaft centerline. The separate cylinders are made of steel with tops made of heat-resisting aluminum alloy. Cast aluminum pistons are used. The valves are provided with two springs and are operated by means of pushrods. Following practice in the United States all movable parts are inclosed for better wear.

The lubrication system is one unit with the engine. The crankcase forms the oil tank of 8.4 gal capacity. The dry sump force-feeding takes care of lubrication in all flying positions by means of one pressure and two suction pumps.

The Sun carburetor, a German type, is provided with an exhaust preheating arrangement for the gas mixture. Each cylinder is equipped with two plugs, two Scintilla magnetos, with automatic ignition adjustment, are used.



The Crown "Custombilt" biplane

THE "CUSTOMBILT", BY CROWN

AT THE present time the Crown Motor Carriage Co., through the Aircraft Division, supplies the Crown B-3 plane on order only. This plane, known as the "Custombilt" holds Approved Type Certificate No 199. Because it is almost completely of wood construction it is particularly adapted to production in a plant specializing on auto body work. Each plane is custom built and finished to the owners' specifications, although all, of course, follow the approved type design insofar as the basic structure is concerned

The B-3 is a two-place sport and training biplane powered with the Kinner K-5 engine. Wing span is the same for both wings, 28 ft. and the total wing area is 236 sq ft. The plane has a length overall of 21 ft. 6 in., and a height of 7 ft. 6 in., with a total weight empty of 1,242 lb. It is a single bay biplane, each lower wing panel attaching directly to fittings on the fuselage structure, while each upper wing panel is attached to a rigid pyramid cabane above the fuselage, no center section being used. Interplane bracing consists of "N" type streamline steel tubing at each bay with bracing by means of streamline wires, six lift and drag wires are used in each bay.

Wings are of wood construction, wire braced and cloth covered. All wing beams are of spruce built up in "I" section. Spruce and plywood ribs and compression members are used along with the U.S.A.-27 wing section. Both Stewart-Hartshorn and MacWhyte wires are used in the wing structure and bracing. Ailerons of the same size are used on all four wing panels, mounted directly to the rear spar in plain bearings and shielded from the wing tips.

The fuselage is built of spruce in Warren truss form with plywood gusset plates, and spruce blocks at all joints, and with the entire fuselage covered with $\frac{1}{8}$ in. 3 ply spruce plywood on the sides and bottom and Haskelite over the arched deck in rear of the pilot's cockpit. A head rest fairing of aluminum is built integral with the deck and extends from the rear of the back cockpit to the vertical fin. The wood decking stops at the point where the leading edge of the horizontal stabilizer is attached to the fuselage, and fairing above the stabilizer is provided by a readily demountable aluminum cover.

The fuselage is reinforced below the stabilizer to the sternpost by covering the inside of the wood truss with plywood. Points of attachment of wings, landing gear, tail skid, and engine mount to the fuselage are reinforced by heavy plates of 1025 steel. The fuselage is heavily braced in front and rear of each cockpit by means of 6 ply laminated $\frac{1}{2}$ in. plywood, the bulkhead in rear of each cockpit being solid, those in front being cut away for leg room. The complete fuselage is finished in Linnoil and covered with Flightex fabric, doped with Brohite, as are all wing and control surfaces

The engine mount is of 5 ply $\frac{3}{4}$ in. Haskelite with steel torque tubes bracing and a steel plate bolted front and rear of the plywood ring to which the engine is bolted

All units of the empennage are of welded steel tube construction, fabric covered and wire braced to the fuselage. The horizontal stabilizer is hinged on the rear spar and adjustable on the forward space by means of a worm and nut mechanism operated by a torque control actuated from either cockpit. All control surfaces, including ailerons, are hinged at three points. Elevators are built in two parts but are bolted together when mounted, and operate as a unit. Control horns except those on the rudder are concealed within the wing or fuselage, and all wires have a direct pull from cockpit to surfaces, no sheaves or pulleys being used anywhere

Both cockpits are upholstered in genuine leather. Dual controls are standard, the front stick being removable. Curved Pyralin windshields are provided, and the front cockpit has a larger door on the left side. The front cockpit is also equipped with built-in luggage compartments on each side of the seat, while a tool compartment is provided beneath the seat in the rear cockpit

Fuel is supplied by a 25-gal tank mounted in the upper portion of the fuselage just forward of the front cockpit and feeding to the carburetor by gravity. A 20 gage duralumin fire wall is mounted in rear of the engine mount and forward of the fuel tank. The nose of the plane is finished in burnished aluminum

Of tripod independent axel type, the landing gear has a seven foot tread and is equipped with Cruss shock absorbing units. Wheels may be either standard wire type, with small tires, or Air Wheels. The latter are standard equipment in the 22x10 in. size with Timken bearing hubs. A simple spring tail skid is rigidly mounted to the fuselage tail post

Officers of the company include: D. M. Brockway, president, M. N. Brockway, vice-president and general manager, and Hagan Barr, secretary and treasurer

Specifications of the Crown B-3:

Length overall	21 ft. 6 in.
Height overall	8 ft. 6 in.
Span (both wings)	28 ft.
Chord	51 in.
Total wing area	236 sq ft.
Airfoil section	U.S.A.-27
Weight of plane empty	1,242 lb.
Normal gross weight loaded	1,726 lb.
Power plant	Kinner K-5 100 hp at 1,800 r.p.m.
Wing loading	7.62 lb. per sq ft.
Power loading	17.56 lb. per hp
Propeller	Story wood
Fuel capacity	25 gal

Beginning with the September issue this section of the magazine will be known as The Salesman's Notebook department and will contain brief articles pertaining to methods of displaying planes, reaching new markets, attracting customers to the showroom, demonstrating, direct mail advertising, etc. Contributions to this department are solicited, and as an inducement to aeronautical merchandising men AVIATION **will pay the sum of $20 for the best article, $10 for the second best, and $5 for every other article printed. Merchandising value, originality and brevity will constitute the judging yardstick. Contributions must be in this office by the fifth of the month for insertion in the following month's issue. ¶ As a send off for the Salesman's Notebook department we publish the accompanying article, which is a reprint of a novel and original brochure prepared by three licensed pilots for distribution to a selected list of 5000 laymen in the Chicago district. Its purpose is to explode the super-man theory and convince the man of 30 to 40 years of age that the airplane is something that he can enjoy just as he enjoys his yacht or motor car.**

YOU CAN LEARN TO FLY

By Three Licensed Pilots

Transport No 1,232
Limited Commercial No 6,389
Private No 10,034

THREE licensed airplane pilots have written this little booklet for the man of, say, 30 or 40 who has looked into the skies and wished he might learn to fly

We have nothing to sell except an idea

And this idea is not directed to the young man who aspires to the motorman's uniform and brass buttons and the monotony of a passenger plane run; nor to the eager devourer of the Make-Big-Money-in-Aviation advertisements

Rather, we hope for the eye of another kind of individual entirely

The sort of chap (it's No 1232 writing now) who could have a chauffeur but would rather drive his own automobile.

The fellow who is a bit fed up on golf, or bridge, or cocktailing (This from No 6389.)

Or, (this is No 10034) the kind of man who appreciates a good duck blind, or the hiss of a busy reel

In other words, the man looking for a real, honest-to-God recreation that will sharpen his sensibilities for business hours.

He can learn to fly

Along with a lot of other legends that grew up with aviation during the war there persists a tradition that the man who can fly an airplane must be a perfect physical specimen (Well, well! remarks No 6389 as he polishes his spectacles My, my! moans No 10034 taking his third dose of bicarb since dinner What's that? asks No. 1232 cupping his right ear)

Another choice bit of bologna remaining from the era of Aces and Asses has it that you ought to know something about spherical trigonometry, calculus, and the Einstein theory to learn to fly Some Phi Beta Kappa got that put into the requirements for flying candidates during the Liberty Motor and Spruce Scandal days.

But the Big Brain notion was somewhat dimmed by subsequent events A fellow from Columbus, Ohio who had majored in automobile racing and got to France as a chauffeur ate up some two dozen German flyers Later, a tow-headed guy who had flunked out of a Western University flew the Atlantic

Just common, every day Horse Sense would seem to suffice and the more of it, the better

But to return to physical requirements: If you can pass an ordinary life-insurance medical examination, it's 10 to 1 that your carcass is perfectly good with the Department of Commerce medical examiner

You may require spectacles You may have a bit of spare tire around the midriff You may smoke a little too much And you must fill in a printed form that asks if you ever use alcohol! You will be asked to juggle two strings attached to pegs that slide back and forth in a camera-like box—a "depth perception" test, or something like that And you must prove that you are not color-blind, wall eyed, cross-eyed, or cock eyed (often)

Don't let the fear of physical disqualification stop you from going on with the idea Find out, anyway

The three fellows who would have you see the clay feet of the 'intrepid birdman" (or at least the clay between his toes) do not minimize in slightest degree the necessity for physical perfection in the *military* aviator. Two of us are ex-Army, the other ex-Navy We simply submit that the man who wants to fly for personal pleasure, who need not be concerned with aerial acrobatics, tight formations and other complexities of military flying, needs only a normal active body and ordinarily good eyesight

If you think there is any standard for Private Pilot physique, come out to the airport where we three hold forth. (More about that later) One of the best "kids" on the field is a runt who might catch on with Singer's Midgets Another—several, in fact—needs a shoe horn, talcum powder, or vaseline to get his German chest into the cockpit of a little sport plane Most of the crowd have corns, bunions, halitosis athlete's foot, or some other well-advertised ailment But, Gosh, we have fun

A great deal of bunk about "flying instinct" has been put forth. Another angle of the "Superman" tradition Of course, to the simpleton who believes that flying an airplane is a cross between tight-wire-walking and trick bicycle-riding, the 'flying instinct" is something to reckon with This is, no doubt, the source of the popular idea that the airplane pilot cannot tell when he is upside down! That the terrific speed of a dive or loop "sends the blood to the head!" That you can't fly if it makes you dizzy to look down out of a high window! That you can't fly if you get seasick!

These are some of the fallacies remaining from a period when the airplane pilot was a sort of glorified county fair balloonist, and the corn and cotton belt yokels paid real money to gape while an ex-lieutenant put on his circus with a war-surplus motor and a weather-beaten old beery crate True enough, these barn-stormers of the haystack-hangar days kept aviation alive as an industry, but their act had to have staging, had to have atmosphere and got it! The modern airplane is as superior to those post-war relics as the "Straight 8" is to a Model T Ford

"Co-ordination of mind and muscle" is another well-worn phrase Such co-

ordination as is needed in flying is about the same required for timing a fairly decent golf swing, for riding a horse, for sailing a small boat, for playing tennis, handball, squash, for socking a baseball, for dusting a clay target or knocking off a mallard, for swimming, for dancing on your own feet, or —no fooling—handling an automobile in heavy traffic Co-ordination? Instinct? Rawzberry If there's any athletic sport at which you are not a downright dub, we three will lay a modest bet that you can learn to fly an airplane

All this may get us labeled Bolshevists by some of our fraternity who rather like the "Superman" theory! It goes big to be regarded as a birdman Particularly as a bachelor birdman We three remember So do three wives

This will be an unusual little booklet if for no other reason than this, that a Transport pilot, a professional, a man who makes a good living out of aviation, does hereby and herein declare that the greatest detriments to aviation in America are the professional "Superman" pilots

Practically every man who has a desire to learn to fly has some relative, or some friend, or knows somebody who has a relative or friend who knows all about flying So, this relative or friend is sounded out Usually, the "expert" is a firm and fast disciple of the Superman cult. It helps his reputation to be regarded as some kind of tin angel.

Meanwhile, aircraft manufacturers the country over are wondering why the "private owner market" doesn't develop, why some fraction of 1 per cent of the men who can afford to learn to fly and afford to own their private planes, don't step forth and say "wrap one up for me"

This condition is responsible for stagnation throughout the entire airplane industry As this written, manufacturers of light, sport planes are wailing and moaning Quantity production cannot be employed to reduce prices and thus broaden greatly the "private owner market" The next higher price group, smaller cabin type ships of 4- and 6-passenger capacity, are waiting for the man who has outgrown his light sport job

Even the manufacturers specializing in large commercial craft are looking for customer-companies that have executives who are private pilots

In the meantime, the professional pilots are at once the hope and curse of the industry Possessing a high degree of proficiency in flying they sit in fatal judgment on the efforts of any manufacturer to provide a ship which less than professional skill can master

To them, wing slots are simply a few miles an hour less speed

Even the plane that won the $100,000 Guggenheim Safety Contest is frowned upon by the average T P

"Too much wing area for hauling only three people," says one "Can't get out of its own way," says another "If I had a hundred of 'em, I'd trade 'em for a pursuit ship," says a third "No sex appeal . . . you'd starve to death goin' a hundred miles . . . about as sporty as a street car" . . . and so on

Left to right Transport No. 1232, Limited Commercial No 6389, Private No 10034

Here and there you find a professional pilot like No 1232 who realizes the desirability of cultivating the private pilot Here and there you find an airport trying to make it easy and safe for the man who wants to learn to fly for pleasure

Such an airport is located just a few miles north of Chicago At the head of the company which operates it is a sportsman pilot

Here, the man who wants to learn to fly gets sympathetic understanding All instructors are veterans Every one is a U S D of C licensed Transport Pilot and Instructor

You are not required to attend a so called "ground school" You will learn all you need to know about airplane rigging, construction, and repair, while you are learning to fly No "class room exercises," here. No "quantity production" methods The atmosphere of the whole place is that of a good country club There is a fine clubhouse with locker room, lounge, restaurant, and the right kind of friends

No red tape Simply present the report of the Department of Commerce Medical Examiner which earns you a Student Pilot Permit Here's a pair of goggles and a helmet Fasten that belt Now, rest your feet lightly on the rudder bar, your right hand lightly on the stick Here we go—

Twenty minutes—a half-hour if you like More if you insist Lessons totaling a couple of hours to teach you simple turns An hour or two at take offs and sharper turns A few hours "shooting" landings You're a real human to your instructor, not just a name or a number Between hops you'll sit in the lee of the hanger and talk it all over You'll soon pick up enough hangar slang And some day, after ten hours or so, he'll climb out of the front seat and tell you to solo the damn thing And you will amazed at the ease of the whole proposition

Put in a little time every day up to the solo. Or, if business prevents that, try to make it at least three or four times a week After supper is an excellent time for the first dozen periods. The air is likely to be smooth. The plane will be as obedient as a baby buggy.

Learning to fly is something like learning to ride a bicycle or to swim for there is that feeling of absolute futility in the early efforts followed by increasing confidence and finally—well, something "clicks" and you've got the knack of the thing

The landing maneuver will be slowest to "click." And most fascinating Little by little, the apparent speed diminishes. You begin to anticipate the point in the decrease of speed when the lift "breaks" and the ship sits down to coast to a stop on the ground. You lose all anxiety Instinctively you pull back the stick at just the right time, keeping the rudder controlled with your feet to prevent swerving until the ship has come to a full stop

The "approach" to the field The glide The leveling These come to you slowly, but once learned they stick. All the time, your instructor is there, alert and encouraging He will show you what happens when flying speed is lost He will show you how emergency landings can be made in case of motor failure.

If, after you have won your private license, you want to go on to learn acrobatics, your instructor will frankly advise you whether you should or not. You may want to know a few simple "stunts" with which to entertain a guest-passenger and these, no doubt, you will perfect

But, better for you than acrobatics, Mr. Private Pilot, will be those hours aloft when rudder-bar and control-stick have become as natural to your touch as the clutch and steering wheel of your car

When your practiced eye sweeps tachometer, motor-temperature and oil gages and reads All's Well without effort or tension

When you relax and settle back at, say, 2,000 ft and streak out for a week-end where there's good fishing, good golf, good hunting, or just good friends

When you watch the changing seasons mottle the patterned carpet of the ground and see the soft green fields grow gold and ripe and then to stubble scar

When you scent, on high, the pines or cool waters of camp-fire smoke

Or the day when you circle that church spire, or the court-house, that seemed so tall when you were but a lad.

Then, you'll have experienced some of the thrills that even an outside loop can't equal

When can we meet you at Palwaukee?

Three Licensed Pilots

THE TRENDS OF ACTIVITY

By R. Sidney Bowen Jr.

Managing Editor of AVIATION

News grows stale and is soon forgotten. Even a review of old news is of little value other than to refresh one's memory on the high points of outstanding events. However, a review of news trends, particularly those which tie in with the progress of an industry, is of unlimited value. It is a sort of industrial progress curve that presents a word picture of existing conditions, permits past and present activity comparisons, and indicates the nature of future development. ¶In an endeavor to render an even more detailed service to readers The Trends of Activity will appear in each new issue of AVIATION.

RECENT activity in the industry presents slight indications that we are making a definite start upward out of the gloomy depths of last winter and early spring. The crepe-hangers who still infest our ranks will undoubtedly scoff at such a statement and point with triumph at the semi annual reports of a few companies. Yet on the other hand, there are unfortunates in every industry and progress is not gauged by them alone, but by the entire membership of the industry. That being true, there is no reason for regarding aeronautics the exception that proves the rule.

True, we could well stand a hundred times the amount of progress we have made in the last few weeks, but the boom period has come and gone, and our encouragement today must be found in the distance we rise above the low water mark.

One indication that gives us hope is in the recently released T.A.T.-Maddux operation report. During its first year of operation the line carried 29,343 pay passengers. That incidently is more than half of the total number of passengers carried on all American lines in 1928, one of the boom years. The important thing, though, is the steady increase in traffic since the fare reduction on January 1. In that month traffic jumped 200 per cent and in the first six months of 1930 a similar traffic increase was attained. It is believed that air transport will be the backbone of the industry, and therefore the T.A.T.-Maddux report is doubly encouraging. It gives added proof to the statement that, "fare not fear has been keeping the layman on the ground."

In another air traffic report distinct signs of progress can be noted. For the first six months of this year the Curtiss-Wright Flying service flew a total of 83,265 passengers on various kinds of trips aloft. Of particular interest in reference to the Curtiss-Wright report is the fact that while the monthly passenger total goes forward by leaps and bounds the number of flying hours increases but very little. That means more seats filled per flight and greater profit with each landing.

Proportionate traffic increases have been reported by smaller air transport organizations, and while the advent of blue ink on the books may still be in the future, the educating of the public to the benefits of air travel appears to be bearing more and more fruit. At any rate we need no longer consider satisfactory traffic to be merely the dream of the madman.

In keeping with the hopeful indications along the airways and on the airports we also note that steps are being taken to make things even better. By order of the Federal Radio Commission the airway radio regulations are to be revamped, the outstanding feature being the creation of five airway chains which will share the use of designated frequencies along the routes indicated. Attention is called to an article in this issue by F. C. Hingsburg entitled "Air Navigation Facilities."

A program for study in the field of international air transportation has been adopted at a recent conference of the Committee on Co-operation Between Civil Aviation Undertakings. Representatives from the leading powers in the world attended this Geneva session and the results of the study to be conducted will undoubtedly benefit American operators. The Johns-Manville Corp. has perfected a fireproof mail bag, and it is to be used over the National Air Transport system. To some that may seem of relatively small importance until thought is given to the amount and value of mail that has been lost by fire.

At this writing United Aircraft and Transport has acquired 57 per cent of the Varney outstanding stock of 10,000 shares. Once again a great transport organization has taken into its fold a good airline. In this respect we see the repetition of railroad history . . . a few big organizations operating their own widespread network of lines, instead of innumerable small owners fighting the wolf at the door.

Several other indications of better days for air transport are noticeable in the recent trends of activity. Each one may appear so unimportant that at the time it is not worthy of a second thought. But when we look them all over they present a picture of steady progress that does much to belie deadlock rumors floating about. A more detailed account of airline operation is contained in an article appearing in this issue under the title of "American Passenger Rates and Patronage."

WHEN it comes to the manufacturing and merchandising side of the industry, progress indications are far from plentiful and not very pronounced. Quantity production is ours whenever we want it, but quantity sales is the long, long battle that has only begun. And, incidentally, it is the one great item that the crepe-hangers leap upon with wild shouts and gesticulations. Fortunately, a few government contracts have been awarded recently and so some manufacturing concerns have work to do and profit to make. However, the commercial side of the picture is not so rosy.

Of course, as we all realized, production for the first six months of this year was way below the 1929 figure. The total of 971 commercial craft for January to June, 1930, as against 3,357 for the whole of 1929 gives us a rather convincing idea as to just how badly off we are. Still, there may be a slight ray of sunshine in this figure recently released by the Aeronautics Branch. The average price for which planes were sold was about 9 per cent less than the average value of all those built. That would seem to indicate that some manufacturers are at least getting rid of a portion of the 1929 production that has been piled up on the shelf. And, if we wish to stretch a point, we might note that a total of 613 gliders have been produced. The glider seems to be becoming a rather profitable side line source of revenue for some manufacturers. For further information regarding the glider situation mention is made of an article in this issue titled "Where Stands the Glider?" by Charles H. Gale, assistant editor of AVIATION.

Engine sales more or less total plane sales. However, the power plant manufacturers were fortunate enough not to have such a big carry over stock as the plane builders, therefore they have been able to reduce their stock on the shelf considerably more.

EXPORTS are less also, but the reduction is estimated by the Aeronautics Trade Division to be only 11 per cent lower than the 1929 figure, and amounts to some $3,591,357 worth of business. Even with a reduction in exports staring us in the face we need not feel so terribly blue, for with the loss we note a gain. Out of the ten countries to which we exported planes, only two took less planes than they did during the corresponding 1929 period. Five countries took more planes. The three new countries sold did not buy anything in the 1929 period. True, there were three countries that we did not sell this year although we sold them last year. However, we only sold them $65,417 worth of goods in 1929 whereas our "new" customers took $203,350 worth of flying "goods."

The engine customers outside the borders of the U. S. A. totaled 21 for the 1930 period as against the same number for 1929. This year we lost nine old ones and gained nine new ones. That's an even break in that respect, but unfortunately the dollars and cents total is slightly in favor of 1929. There is some sunshine, nevertheless, for five of last year's customers took less and six of them took more.

The parts business abroad is even more encouraging. We lost eight first-six-months-of-1929 customers but we gained 17 new ones. And although eight of the old customers took a less amount of goods this year, and only six of them took more, the total value of goods shipped to new customers was considerably more than the total value of sales lost. As a matter of fact the actual total parts sales value for this year was exactly $93,449 more than for the same period last year.

Therefore it would seem that although our domestic market is suffering from readjustment pains we are succeeding in developing a variety of markets abroad. With selling agents continually working in foreign lands, in addition to the goodwill work of government representatives, there is every reason to believe that the export business of American aeronautic products is making sound progress. If not in the way of total sales value, then in the way of opening up new markets in foreign lands. If that sort of development continues the total sales value will soon take care of itself.

Incidentally, while we are on the subject of foreign markets, one trend of recent activity is the encouraging of taking planes abroad for use in pleasure traveling. A questionnaire to be filled out on such occasions has been suggested by Hugh R. Wilson, Minister to Switzerland, for promulgation by the Department of State. It is not official as yet and in its original form applies only to Switzerland. However, it can be easily made applicable to many of the rules existing in other countries. Time alone will tell us how much the manufacturer will gain through the free advertising that such an idea would give his product in foreign climes. Yet it is not far fetched to believe that tourist-flier encouragement would help the sale of private planes in this country.

Although it is something that can virtually change for the worse over night, aeronautical finance is slowly recovering its strength. Aeronautic stocks while still fluttering slightly above their lows for the year have recovered some of the loss they experienced when carried down with the general decline in the market. Transport stocks in particular have made encouraging recoveries. Of course the aircraft stock speculator is not present in such numbers as in days gone by. However indications point toward an increased amount of selective investment in the industry by the outside public, and as the financial readjustment period continues, and the dead-head companies are further weeded out, it is not altogether improbable that many who were bitten by wild cat ventures will re-enter the market and make intelligent and sound investments. Some semi-annual statements of leading aero companies show substantial loss, yet on the other hand they also show an increase of orders received in the last few weeks.

A detailed account of the financial experience of 1929 as shown by the financial reports is contained in an article printed elsewhere in this issue. The article is entitled, "The industry's Income for 1929," and is by R. R. Doane.

While practically no new aeronautic firms have been announced recently we note that final reorganization plans by which the B/J (Berliner-Joyce) Aircraft Corporation of Baltimore, was merged with North American Aviation have been completed. The new B/J corporation is the first airplane manufacturing unit to be wholly owned by North American Aviation.

A REVIEW of legal and governmental matters brings to light some interesting decisions and development trends.

For many years owners of property adjacent to flying fields have battled in court for the award to them of damages against the flying field owners because of planes flying too low. The case of Fred L. Swetland and Raymond H. Swetland against the Curtiss-Airports Corporation, Ohio Air Terminals, Inc., and Curtiss Flying Service, brought into federal court a year ago, was recently settled by Federal Judge George P. Hahn who established a precedent by fixing 500 ft. as the minimum altitude which must be maintained over suburban districts in order not to trespass on the estates of property owners. The case has attracted widespread attention, and because of the decision will undoubtedly be sited in court many times in the future.

However, the decision applies only to the case at hand. While Judge Hahn ruled that under the conditions presented 500 ft. was the minimum, he also stated that under different condition 600 ft. or even higher could be ruled as the minimum height.

The item of aeronautical insurance has produced many problems and caused many headaches. The decision of the Superior Court of Montreal, Canada, in regard to an insurance company's refusal to recognize the claims of a company which owned a plane that was written off on a test flight, interpreted

Wing Commander Kingsford-Smith arriving at Roosevelt Field, Long Island, N. Y., June 26

an insurance policy to favor the plaintiff. The plane which was purchased as a land plane and changed to a seaplane went out of control on a test flight and crashed. Apart from the engine nothing was salvaged. The defendant claimed that because of the landing gear conversion the craft was not airworthy. The court ruled that the defendant had failed to prove the plane unworthy and pointed out that it had been built in the United States and had its A.T.C. and that such certificate is accepted as sufficient by the Department of National Defence, Air Service Branch, in Canada. This decision on an American product in a foreign country is of exceptional interest as it is based on the reciprocal agreement covering international flying entered into last November by Canada and the United States.

SOME weeks ago the rules governing the issuing of Certificates of Authority for airlines were released by the Aeronautics Branch, and more recently the Branch has issued interpretations of the provisions. As yet they have not been finally promulgated and merely indicate departmental opinion. In order that mail operators in particular may further study the provisions and take up any questions with the Department the period of grace before the filing of Certificate applications by individual air lines has been extended from July 15 to August 15.

The Branch's interpretations indicate such things as the actual instruments and equipment to be provided for the given service rendered, type of maps to be carried, and navigation and landing lights as well as flashlights and parachute flares to be used. They also determine what radio equipment is to be carried when such equipment has become suitably available and its practical application demonstrated. Radio, however, is not to be definitely required as yet. The interpretations also state what personnel is to be maintained for various kinds of flying and under various conditions.

The results of this new regulation of air traffic by the Government is awaited with considerable interest by the entire industry. While it may prove disastrous to some of the lesser airlines, on the surface it appears to be another important step forward by the Government for the general benefit of American airlines. It will undoubtedly have the same good effect on the traveling public as the A.T.C. has upon the prospective plane purchaser. And it will also go far toward removing undesirable operators just as the inception of the A.T.C. removed backyard and fly-by-night manufacturers.

In connection with the above comments we call attention to an article printed in this issue entitled "Government and Airplanes—Regulation and Control," by Edward P. Warner, editor of AVIATION. In this article American practices are cast in relief against the diversified background of European regulations.

Another commendable step taken by the Government in its attempt to maintain safety in the air is its recent refusal to sanction a proposed attempt by a New York group to re-crew on a refueling flight. The Aeronautics Branch has made it plain that it favors aerial accomplishments that make for general development but that it is flatly against the needless risking of lives in wild stunts.

It is a happy coincidence that aerial ventures of the past few weeks have really benefited the industry to some extent. Good publicity is always welcome for it all helps on the front page. However, there have been many occasions in the past when the industry got on the front page to its own disadvantage.

The splendid flight of Wing Commander Charles Kingsford Smith and his companions across the North Atlantic in an east-west direction is perhaps the most outstanding example of helpful publicity. The public as well as

Air picture of the Stinson Detroiter "City of Chicago" about to make a contact during its recent record breaking stay aloft

ourselves know full well that a regular east-west or west-east commercial service over that North Atlantic stretch is something to hope for in the future not now. Nevertheless, the fact that airplane radio equipment played so important a part in Kingsford-Smith's flight has undoubtedly made a lasting impression on the public. The fact that practically constant communication was maintained has undoubtedly done much to dispel the fears of the layman in his belief that once aloft his fate is in the lap of the gods because he has lost all contact with the world.

The record breaking endurance flight of the Hunter brothers has also left some favorable impressions on the public. True it was a stunt venture and from a strictly aeronautic point of view proved nothing of real value to future development. Yet on the other hand the day and night soaring of that plane must have caused many to marvel at the splendid performance of the engine and the workmanship in the structure of the plane which did not fall apart after seemingly endless hours of constant vibration. And one thing that might go unnoticed by many of us in the industry, but not so with the public, is the relatively few hours that the Hunter boys had to their credit before they went aloft in their plane to attract international recognition.

The remarkable flight of Roger Q. Williams to Bermuda and back is practically certain to result in additional near future progress. Many organizations have cast speculative eyes at that New York to Bermuda stretch with thoughts of establishing an airline that would link up the popular resort with the mainland. A combination of things hindered development and one of them was seemingly unsatisfactory equipment available. Another was the uncertainty of success. One experimental flight was unsuccessful and the plane and occupants spent the night floating atop the crests of the waves. Possible backers shook their heads and turned to other matters.

And then, without advance publicity or elaborate preparation, and with a plane that should have long ago been placed in the hall of air fame, Williams and two companions took off from Roosevelt field, slipped out over the water, hit the island on the nose and then came back without landing. Such a matter-of-course accomplishment is bound to renew interest in the establishment of a scheduled airline between the two points.

IN CONCLUSION we again call attention to the fact that slow as it may appear we are making progress. Individually each item of development indication is hardly worthy of notice. But when one puts into its place the air traffic increases, the number of new airports and schools springing into being, the widening of our foreign markets, the regulatory improvements by the government, the steady bettering of financial conditions, the increasing goodwill and admiration of the public, and a hundred other different things, the whole business presents a panorama of aeronautical development that, while open to unlimited improvement, is really much better than it was even two months ago.

We are now in the middle of what is regarded as the aeronautical selling season. The indications that we have already noted leave us with the opinion that there will be a continued increase during the next few weeks. The slow rate of increase may be exasperating, but it should be remembered that any gain is a good sign. We are just starting on the long road to recovery. Sound progress, slow as it may be, will be far better than the headlong rushing we did during the boom period.

What Our Readers Say

"What's Easy?"

[A Reply to Mr. Robert M. Burtt's Article Appearing in AVIATION, June 28th.]

TO THE EDITOR:

"This Matter of Salesmanship and the Truth," an article of Mr. Robert M. Burtt's, appearing in the June 28th issue of AVIATION, brings up many things, together with the old, old problem of "what is the truth"? Mr. Burtt objects to salesmen claiming that "It's easy to fly," but what is easy?

Reputedly, it is fairly easy, though perhaps irksome, to take the Saturday night bath, but the accident insurance companies report the bath tub as one of their greatest sources of accident losses. They, also, say that thousands of people insist on killing themselves by falling down stairways, yet all this is supposed to be easy.

First of all, we should define the terms. The airplane salesmen are not telling the public that it is easy to fly an army or navy pursuit ship in formation and through acrobatics, nor is it claimed that it is easy to fly the night mail, nor to handle a big transport ship in emergencies, but it is rightfully claimed that the flying of light, well powered, quick take-off, slow landing, airplanes is easy, and easy in comparison with what the average man is doing in his daily life. The measure of this easiness is *not necessarily* the arbitrary standards set up by the Department of Commerce for a Private Pilot's License.

How many automobile drivers could pass the test for visual depth of perception? Yet this very same depth of perception is far more important in automobile driving than it is in flying. Take the simple and so called easy operation of passing another car on the highway and in the face of a third car approaching in the other direction. Is it so easy to judge the speed of the car ahead of you and decide that you can or cannot get around it before the car coming from the other direction reaches you?

I recall the ease of a rather prominent pilot who tried this at somewhere between seventy and eighty miles per hour and clipped his left front fender on the approaching car, while the car which he passed took off a portion of his right rear fender. Certainly it is easy to steer automobiles slowly on a straight highway, but with the traffic we have combined with the lack of driving skill displayed by so much of that traffic, it now is not so easy to drive an automobile.

Obviously, the right kind of action in an emergency is always desirable. We believe that the average novice pilot is perfectly willing to go out and practice his art as thoroughly as he practices his game of golf, but while we may be very conscientious about our training for the inevitable forced landing in an airplane, we must not overlook the fact that we have other emergencies in our daily life equally important. Take for instance a tire blow-out on the front wheel of your car, particularly if it happens in heavy traffic. Rather unpleasant to think about, but we do not go out purposely and practice driving with ancient tires to practice the art of handling a car when a tire blows. We believe that the public has not been told the truth on flying because the public still retains much of its wartime view of the hazards of flying, and also because the livelihood of many pilots has depended on their reputation for daring and recklessness, as well as on their income from instructing the public in this so-called difficult art of flying.

Let us not confuse professional flying with amateur pleasure flying, and let us admit to the public that it is the exceptional man who *cannot* learn to fly, rather than the exceptional person who can fly. The average man has been doing many difficult things without admitting that they are difficult. Every year many people are killed falling off horses. Thousands of people are drowned trying to learn how easy it is to swim. Thousands of people are killed in automobile accidents yet it is easy to drive a car. The Department of Commerce does not regulate nor license motorcycle drivers, but if any airplane pilot wants a real thrill in his young life I suggest that he try handling a high powered motorcycle. It all gets down to learning the *truth* about what's easy, and it must be admitted that if a man is thoroughly convinced that a thing is easy to do he will find it much easier to do than if he felt it were difficult.

It's easy to fly!

ROBERT E. LEES
Sales Manager
Waco Aircraft Co.

The Pulitzer Racers

TO THE EDITOR:

In reading the June 21 edition of AVIATION I noticed an article on "Racing Seaplanes—Present and Future" by John S. Kean. The article was interesting and contained a lot of good information. However, in paragraph three Mr. Kean makes this statement: "It will be remembered that the first Pulitzer racers were simply 'dressed up' pursuit planes while subsequent racers were refinements of the preceding winners."

While at the Curtiss Company I was intimately connected with the racer development and I can assure Mr. Kean that they were far from being "dressed up" pursuit ships.

The Pulitzer racers developed by the Curtiss Company were all of original design, considerable thought and research being put on the design of each racer, both structurally and aerodynamically. Some of the important features developed were wing radiators, plywood type of wing construction as used on the racers, improved type of plywood construction used for fuselage construction, development of racing airfoils, improvement in power plants and many other refinements which, of course, later were adopted on some of the pursuit ships. Most of these developments have also been incorporated on the latest racers.

Too many hours were spent on these developments to let them pass as being incidental to "dressed up" pursuit ships. Naturally as each new model was designed it was a refinement on the preceding article which is considered good engineering practice. However, each subsequent model had also many new ideas incorporated in the design and I believe the results speak for themselves.

F. S. HUBBARD
Berliner-Joyce Aircraft Corp.

Exchange of Compliments

TO THE EDITOR:

Kindly grant me a few words of comment on review of my book "The Wright Brothers: Fathers of Flight," by Eric F. Hodgins in your issue of April 12. I appreciate the honest frankness and vigor of such a review which stands out among many as something vertebrate in a school of jellyfish. My salaams are also due for compliments as to style and yet more for the statements conveying the fact that the work illuminates the airplane origin and has historical value.

But Mr. Hodgins finds that this is not the last word of serious history on its subject. I agree. This merely happens to be the first adult book on the Wrights. Hundreds more will appear in due time. They will be done from every angle of the popular and the technical. Among them will be calm, detached, very serious and somewhat sleepy histories weighing a myriad of microscopic facts in vacuo and with infinitely delicate precision. Is a writer of today expected to turn out such a work of tomorrow? No one could if he would. The pretention of catering to the future, rendering final judgment, being wholly objective, scorning the vulgar present with all its storm and stress, is not mine.

I have done a more or less artistic close-up of the Wrights and have emphasized the features of the portrait as required to impress the truth upon today's reader. That reader's head already buzzes with the long list of predecessors cited by Mr. Hodgins, whereby he is confused and imagines vain things and does not realize that after all just two men gave the world

usable wings. Perhaps the reader of to-morrow can stand the roll call of predecessors without getting the false notion that their activities were highly important and even essential steps toward the conquest of the air. However, pages 245-6 of my book do mention fourteen predecessors as considered by a federal judge, and others are mentioned elsewhere.

Mr. Hodgins thinks that I labor too hard and protest too much to establish the pioneer place of the Wrights, which in 1930 is "a matter of universal acceptance." On this point I am supported by Brig. Gen. Frank P. Lahm, Air Corps, U. S. Army, who writes: "I am particularly pleased to see your defense of them [the Wrights] as the fathers of flight. It is essential that for the benefit of future generations this matter should be made clear and you have done so."

The continued exile of the Kitty Hawk plane in a London museum indicates that something is yet lacking in the "universal acceptance" of the Wrights—namely, a true conversion of certain academic minds in Washington which would lead to suitable amends and the restoration of a great historical relic to its native land.

A few errors in fact are alleged by Mr. Hodgins. Where is his evidence? If there is any truth in his charge of "an air of bad temper" in the book, I apologize humbly to him and to all readers. I aimed to tell the story with good temper and as fairly as possible.

JOHN R. MCMAHON.

TO THE EDITOR:

Mr. McMahon's rejoinder to my review of his book "The Wright Brothers: Fathers of Flight" is so pleasantly phrased that I wish it were possible for me to agree with all he says. It was, however, for the very reason that Mr. McMahon's book was the "first adult book on the Wrights" that I criticized it for its lack of objectivity. Mr. McMahon did not have two hard and fast alternatives: one, to be serious and sleepy; the other, to write his book as he did. It is quite possible to be interesting and lively without becoming over partisan.

I only wish that I could believe that his treatment did "impress the truth upon today's reader." When Mr. McMahon asserts that the Wright Brothers did not in any way derive from the experiences of the "long list of predecessors", he takes a stand just as logical as he would if he had claimed not only to have written his book but to have invented grammar, rhetoric, punctuation and the alphabet. To deny to the Wrights the credit they deserve is one error; to insist that only they deserve any credit is another. I cannot see that the continued exile of the Kitty Hawk plane in the Science Museum has any bearing on this truth. It merely illuminates the fact that Mr. Orville Wright has, quite understandably, not yet forgiven the Smithsonian Institution for its now confessed errors of the past. There is no longer any label upon the Langley plane to detract in any way from the credit due to Wilbur and Orville Wright.

Most of the errors in fact which I alleged are, I think, fairly clear. "Langley's Law" was not a statement of the "something for nothing principle" but was, rather, the sound if empirical statement that the faster an airfoil was carried through the air the less was the power required to *sustain* it independent of the power required to *drive* it against friction. That has, in fact, been confirmed by the recent work of German students of induced drag. That the Wright brothers did no flying in 1907 is contradicted by Orville Wright himself writing on page 736 of AVIATION for December 17, 1923. That Chanute's gliders had been failures in the hands of his assistant Herring is not so unless Mr. McMahon is prepared to say that Octave Chanute, an engineer sufficiently illustrious to have been one time President of the American Society of Civil Engineers, was guilty of monstrous fabrications in a paper which he delivered before the Western Society of Engineers on October 20, 1897, and that all of the more than a score of landing slides presented were faked. And the wind tunnel, instead of having been invented by the Wright Brothers, dates at least from Captain Renard about 1878, as shown by Dr. J. R. Pannell of the British government's aerodynamical staff in a paper on wind tunnel history a dozen years ago.

ERIC HODGINS.

Selling Safety

TO THE EDITOR:

I appreciate your sending me an advance proof on the editorial in the June 28 issue of AVIATION, entitled "Advertising Safety."

I am in full accord with the attitude which the editorial expresses. The natural reaction of the layman is hesitation to get off the ground—often, even onto the water. I do not believe that the general public will become convinced that airplanes are safe, reliable carriers through lack of mention of safety factors or records of operation. Rather, these should be emphasized to a point where the public will believe that they are usual instead of unusual.

I also feel that the consideration of safety goes further, namely, into the problem of design. While experienced pilots may always want aircraft of high speed, and while it may be that high speed will always carry with it a relatively high landing speed, it has seemed to me that the development of an airplane which would make ease of learning to fly and ease of landing its primary purposes combined with comfort for the passenger, quietness, and lack of vibration, is essential to get private owners into the air in substantial numbers either for sport, pleasure, or business. Such an airplane must be essentially safe. It would not be designed for acrobatic maneuverability but rather for sane, straight flying. As soon as some commercial manufacturer realizes that there are multitudes of people who would like to get into the air if they could feel that they were flying a ship of high intrinsic safety where the ability of the pilot in making landings is reduced to a minimum even at a substantial sacrifice in speed, and when he produces such a ship, in my opinion, he will have taken a great step in the popularization and advancement of aviation.

HARVEY L. WILLIAMS,
President,
Air Investors, Inc.,
New York City.

Cooperation

TO THE EDITOR:

As usual, I enjoy reading your editorial comments and particularly, I would like to refer to your editorial, "The Public Response," appearing on page 1206 of the June 21st issue in the next to the last paragraph and sentences: " . . . There has been talk from time to time of the need of the moment being primarily for designers, or for production men, or for salesmen, or for operators. At present, we have to have all four, but responsibility for the future lies largely on the technical side."

I quite agree with you, but we need a great deal more cordial cooperation between the designers, the production men, the salesmen and the operators than we have at present. There is too much jealousy of each other's field and too little cooperation. Perhaps, one way to get that cooperation is the introduction of greater executive supervision by men who may or may not be intimately acquainted with aviation, but who are intimately acquainted with executive work in other fields. That, of course, immediately starts an argument. Nevertheless, I know of several companies where such executive supervision is being provided with distinct results.

D. F. WALKER,
Manager,
National Glider Ass'n., Inc.

A Correction

TO THE EDITOR:

I want to call your attention to an article emanating from Wilmington, Delaware, which appears on page 1184, column 1, in AVIATION of June 14th, regarding the suit of the Irving Air Chute Company, Inc., and the Floyd Smith Aerial Equipment Company vs Russell Parachute Co. In this article it is erroneously stated: "These patents were originally taken out by Floyd Smith when he and J. M. Russell, Vice-President and Chief Engineer of the Russell Company, were among a group of parachute engineers who in 1919 designed a parachute for use of the United States Air Corps."

The facts are these: My patent No. 1,340,423 which is the patent in question, was filed July 27th, 1918, long before Mr. Russell came into the picture.

In 1918 I built and tested the chute and pack which early in 1919 was used by Mr. Leslie L. Irvin and myself for the first free, manually-operated jumps, resulting in this type pack being adopted by the United States Air Corps.

There were no parachute engineers connected with this work. I obtained the services of Mr. Russell as field mechanic and general assistant in 1919, long after my free type pack was proven.

All this foregoing information has been public knowledge at least since my suit, "Floyd Smith Aerial Equipment Company vs. Irving Air Chute Company, Inc., United States District Court, Buffalo, New York, Judge Hazel, June 19th, 1921," and I cannot realize how the news agency that supplied the above mentioned article to AVIATION could have made such a mistake accidentally.

This is an important matter to me. I invite the fullest investigation, and will appreciate a correction.

FLOYD SMITH,
Floyd Smith Safety Chute Co.,
Buffalo, N. Y.

A Suggestion

TO THE EDITOR:

In connection with the change in the publication policy of AVIATION, may I suggest that each month there be some space devoted to Lighter-than-Air?

Activity in this field did not justify a department dealing exclusively with Lighter-than-Air when AVIATION was published as a weekly magazine, but now that it is a monthly publication there might well be some space in each issue devoted to problems and developments in this particular field, and especially those pertaining to its commercial application. Technical achievements, governmental policies, economic possibilities and international relationships are only a few of the subjects that might form the basis for articles and editorial comment.

The aircraft industry is primarily concerned with transportation and national defense. Lighter-than-Air, in my opinion, has demonstrated that it is worthy of serious consideration by all parties in interest.

Here's hoping you agree.

WM. P. MACCRACKEN, JR.
Washington, D. C.

An Encouraging Development

TO THE EDITOR:

In spite of two recent depressions in aircraft, which resulted primarily from the general slowing down of business, there is one extremely encouraging development.

Up to last year a large amount of the efforts of the flying schools of the country, as well as aircraft dealers, was focused on the young fellow of limited financial resources who expected to make a living out of flying. While many of the schools derived a satisfactory income from this source, few of these graduates after securing their licenses were financially able to purchase ships.

This year for the first time, we have found definite evidence that the "older third" of the population were at last beginning to accept flying in a personal way both for business and pleasure purposes. This group not only includes those who sign the checks but also, to a large measure, the people who dominate public opinion. The fact that the older business man is now willing to buy airplanes either for himself or his children also indicates that the American woman, as a class, is beginning to accept in a philosophical if not enthusiastic manner the idea of her husband or son getting into the air.

I feel that an important mile post has thus been passed and from this time on commercial aviation will make steady progress on a firm foundation.

B. F. CASTLE,
President,
Great Lakes Aircraft Corp.

Giant Airplanes

TO THE EDITOR:

The remarks contained in your editorial of June 14th concerning "Giant Airplanes" are quite in line with my viewpoint and I am happy to see you point out that airplanes can be too large for the purpose intended. If I have any preference as to the airplanes I like to design, it is probably the larger type.

From the viewpoint of the designer and manufacturer there appears to be no limit to the size of airplanes which can be built but there is a limit to the size which can be bought for a reasonable price. This limit is brought about by the combined effect of available materials, available engines and present day manufacturing facilities and I think that this limit can only be raised very slowly. For example, when 1,000 horsepower Diesel engines are readily available designers will develop steel construction to suit, and manufacturing equipment and methods will be revised so that larger airplanes can be built to sell at a price which will offer the operator some advantage in using them. And when that fundamental step has really been consolidated no doubt other increases in size will follow. But in the meantime we should not lose sight of the fact that any airplane must be an economical unit, which is to say that its overhead must be reasonable. The black eye which great airplanes have accumulated for themselves in the past was due, I think, to the fact that such airplanes were too far ahead of established practice and I believe that if we will work up to the larger sizes more gradually we will find that there is some increase in operating efficiency in the larger sizes provided they are built with suitable materials to suitable designs and constructed in factories which have developed economical manufacturing practice for the large sizes. Imagine carrying the overhead on a DOX not to mention keeping twelve motors in repair or buying spare wings occasionally.

Sometime ago you published prophecies by various people in aeronautics concerning progress in 1930. I have been wondering if there is any similarity between the various prophecies and the actual facts.

LESSITER C. MILBURN,
Vice-President-Chief Engineer,
The Glenn L. Martin Company.

Anonymous Correspondence

[We regret that we are unable to publish sundry letters, especially that of L. E. M., No. 7126, as it is our invariable rule to require that all correspondence for publication be signed.—Ed.]

Abstracts and Reviews

RADIO SHIELDING FOR ENGINES

ENGINE-IGNITION SHIELDING FOR RADIO RECEPTION IN AIRCRAFT. *By H. Diamond and F. G. Gardner, Bureau of Standards Research Paper No. 158.*

THE increasing use of radio sets in aircraft for the reception of weather reports and for navigational purposes has made necessary the development of a shielding for the ignition systems of the engines so as to eliminate interference from that source.

The Bureau of Standards has cooperated with several manufacturers of airplane engines and engine accessories with the object of perfecting a shielding system practicable for installation on modern commercial transport planes. The difficulties experienced are explained, and the shielding system as finally developed is described and illustrated in Research Paper No. 158.

Actually the problem was not so much to shield the radio equipment from interference due to ignition, which was comparatively easy, as to do this without at the same time adversely affecting the engine-ignition system. Early experiments with the high tension leads separately shielded by means of a woven copper braid, magneto distributor blocks

covered with metal cans, a metallic enclosure of the ignition switch and shielded spark plugs gave complete satisfaction as far as the elimination of interference with the radio system was concerned. But practical difficulties were encountered. Not only was there trouble from the maintenance viewpoint but it was found that the individually shielded leads had a capacitance several times that of the usual unshielded type, resulting in faulty ignition under certain conditions. These faults were eliminated one by one until the shielded assembly as now perfected for commercial use is practically free from such troubles. It employs a metal manifold ring with unshielded high tension cable drawn through it in the usual manner. From the manifold to the spark plug each lead is enclosed in a liquid-proof aluminum tube, while the groups of leads from the manifold to the magneto outlet are similarly covered. Elbow type shielded spark plugs are used with an attachment to the lead and its aluminum tubing which permits of easy servicing. The magneto cover, developed in cooperation with the Scintilla Company, not only effectively shields the magneto but allows ready inspection of the distributor blocks and magneto proper. Care was taken in the design to provide protection against rain. The whole assembly, as now available commercially for Wright and Pratt-Whitney engines, provides satisfactory shielding, full mechanical and electrical protection for the component parts of the ignition system, liquid proofing of the magnetos, spark plugs, and ignition cable, and ease of installation and servicing. The weight added to the ignition system to provide for this shielding is only about 5 or 6 pounds.

The concluding part of this paper is given over to an outline of tests suggested as a means of determining the practicability of any shielding system.

TAIL FLUTTER ANALYSES

THE FLUTTER OF AEROPLANE TAILS, *By R. A. Frazer and W. J. Duncan, British Aeronautical Research Committee R. & M. No. 1237.*

THIS report is divided into two parts. Part I gives a general survey of the dynamical theory of tail flutter and divergences while Part II gives an account of some wind tunnel experiments the results of which are in good accord with the theoretical conclusions.

The methods of treating with the problem of tail flutter, as outlined in the report were analogous to those used for wing flutter in R. & M. 1155. The underlying principle is the substitution of semi-rigid counterparts for such portions of the moving system as are likely to distort appreciably under the acting loads. Thus it was assumed that the tailplane, fin and fuselage could be treated as semi-rigid and that the rudder and elevators were rigid. Motion was limited to angular movements of the elevators and rudder, flexure and torsion of tailplane and fin, and twist of the fuselage.

Under these assumptions two types of tail flutter are possible:

(a) Symmetrical. The port and starboard elevators move freely and in phase, the rudder does not turn, and the fuselage does not twist.

(b) Antisymmetrical. This includes all oscillations of the rudder and the two elevators (the latter not in phase), and twist of the fuselage.

Symmetrical flutter requires, in general, flexibility of the tailplane. This form of flutter is analogous to ternary wing flutter when the aileron is free from elastic constraint, and the recommendations of R. & M. 1155 may be applied.

This investigation was restricted mainly to an examination of the conditions for the avoidance of tail flutter of the antisymmetrical type.

Having made the assumptions listed above the dynamical equations were derived, the solutions of which gave the conditions necessary for stability. Study of the results permitted the recommendation of certain measures for the prevention of flutter. The principal conclusions drawn from the theory were:

(a) Rudder flutter can be eliminated completely if a rigidly constructed rudder is extended symmetrically above and below the axis of fuselage twist. If this cannot be done a suitable mass distribution and hinge location will dispose of the flutter.

(b) Interconnection of the two elevator planes by a tube very stiff in torsion will eliminate the anti-symmetrical elevator flutter.

(c) Merely moderate increase of the torsional stiffness of the fuselage appears to offer no advantage and may actually tend to promote flutter.

In general, the recommendations for the elimination of wing flutter apply also to the prevention of tail flutter, both symmetrical and antisymmetrical. Thus the principal design features recommended were:

1. Fixed surfaces should be very stiff in both flexure and torsion.
2. A type of irreversible control system is desirable.
3. The movable surfaces should have zero products of inertia and small moments of inertia, they should be definitely underbalanced aerodynamically and their motion should be heavily damped.
4. The elevators should be interconnected by a tube very stiff in torsion.

As a test of the theoretical conclusions reached in Part I, some wind tunnel experiments were conducted on antisymmetrical tail flutter. The models of tail surfaces used in these experiments were made up of rigid components, elastic constraint being provided where necessary by means of steel springs. The results of the tests were in general accord with the conclusions made from the theoretical discussion.

VISUAL REED RADIO BEACON

A 12-COURSE RADIO RANGE FOR GUIDING AIRCRAFT WITH TUNED REED VISUAL INDICATION, *By H. Diamond and F. G. Kear, Bureau of Standards Research Paper No. 154.*

TO PROVIDE for the increases in the number of airways emanating from some of the more important airports in this country, the Bureau of Standards has developed a 12-course radio-directive beacon of the visual indicating type.

This 12-course range is similar in operation to the 2 and 4-course ranges previously developed and now in use. It employs the same crossed-coil antenna system and the same circuit arrangement except that three amplifier branches modulated to three different low frequencies are necessary. The modulation frequencies used are 65, 86.7 and 108.3, respectively. A special goniometer is required also. The rotor system of this goniometer comprises two coils crossed at 90, and each connected in series with one loop antenna. Three stator coils, normally placed at 120 with each other, are employed, one stator coil being connected to each power amplifier tube of the transmitting system.

Each stator coil, acting in conjunction with the two crossed rotor coils and the two crossed loop antennas, sets up a system which is electrically equivalent to a single loop antenna. The plane of this phantom antenna coincides with the plane of the stator winding for zero setting of the rotor but rotates in space as the rotor system is rotated. If special precautions are taken in circuit design the combined space pattern may be made to consist of a circular carrier with three figure-of-eight side bands crossed at 120.

With a 2-reed type of vibrating-reed course indicator tuned to any one of the three frequencies, 4 courses may be found, but the use of a three-reed indicator recently developed permits the receiving of all 12 courses of the beacon without confusion.

The beacon courses may be varied by displacing the stator windings from their normal 120 course.

Tests have indicated that under average daytime conditions a distance of 100 miles on the weak courses, with correspondingly greater ranges on the strong courses, may be expected.

SPLIT FLAP AND SLOT AIRFOIL TESTS

WIND TUNNEL TESTS ON AN AIRFOIL EQUIPPED WITH A SPLIT FLAP AND A SLOT, *N.A.C.A. Technical Report No. 324.*

A MODEL having a slot at the leading edge connected by an air passage through the airfoil to a split flap at the trailing edge was recently tested

in the Five Foot Atmospheric Wind Tunnel of the Langley Memorial Aeronautical Laboratory. Knowing that the removal of the boundary layer by suction from within the airfoil increases the lift and that a split flap at the trailing edge creates suction, it was thought that perhaps a split flap might create sufficient suction to draw the air through the slot and through the interior of the airfoil to the trailing edge, thus improving the Aerodynamic characteristics. The slot was $\frac{3}{4}$" wide and covered with a fine mesh cloth. The model had a 15 in. chord and a 25½" span. It was mounted vertically between large horizontal planes that restrained the air flow to two dimensions allowing the effect of infinite aspect ratio to be approximated. The model was supported by a vertical spindle passing through and rigidly fastened to it and the two end disks. The lower end was pivoted and to the upper end were attached the force measuring balances by means of wire linkages. Air was prevented from passing between the disks and planes by means of two liquid seals.

Lift, drag and pressure on the inside of the airfoil were measured at various flap settings with and without the slot. For the tests without the slot a solid leading edge piece was used. The pressure inside the airfoil was measured in terms of dynamic pressure with reference to the static pressure in the test section of the tunnel. The pressure difference without the slot was that produced between the open parts of the flap by the air flow past them. By a comparison of the pressure differences with and without the slot the direction of air flowing through was determined.

It was found that so long as the air flow was in through the slot, the lift was increased with practically no change in drag, but that when the flow was reversed, there was a considerable decrease in lift and increase in drag. This reversal of flow took place at about $\frac{2}{3}$ of the maximum lift coefficient of the airfoil without the slot, the maximum lift with the slot was considerably reduced. At high angles of attack, after the complete burble of the airfoil, the lift coefficient was slightly increased, although the pressures indicated that the air was flowing out through the slot. It is thus seen that the addition of the gauze covered slot reduced the maximum lift coefficient of the airfoil because the split flap did not furnish the pressure difference required for the operation of the slot at the angles of attack of the larger lift coefficients.

WAR FLYING IN THE MOVIES

THE DAWN PATROL, *a screen version of The Flight Commander, by John Monk Saunders, Directed by Howard Hawks and presented by First National.*

THIS talking picture, starring Richard Barthelmess, is an exceptionally true-to-life portrayal of the British aviator's existence on the Western Front in 1915. There are no women or villains included but there is an abundance of action both in the air and on the ground. Although the picture has no particular plot, it depicts in a most convincing manner the relatively short period of life allowed the fighting pilot in the early days. In addition it pictures the altogether unenviable position of the squadron leader who because of G.H.Q. orders is earthbound and forced to send others to the slaughter instead. The fact that they include new pilots as well as veterans and his best friend does not improve his mental state at all. In turn the two leading pilots who damn the C.O. for his heartlessness are placed in command and compelled to be the very same sort of person as their former superior. The rebellion of one of them against sending his pal to certain death gives the picture a smashing climax.

The air work of "The Dawn Patrol" has yet to be equaled on the screen. The acting of all concerned is deserving of highest praise. The detail of the picture is particularly good. Unfortunately, in most war air pictures there has been much that brought derisive laughter to the war pilot sitting in the audience. In "The Dawn Patrol," however, there is little if anything that was not so at that time.

New Volumes for the Shelves

A NEW GENERAL MITCHELL

SKYWAYS, *by General William Mitchell, J. B. Lippincott Co., 307 pp., $3.*

FOR the first time in five years, Gen. Mitchell puts his views on aeronautical matters between the covers of a book. The comparison of "Skyways" with "Winged Defense" and "Our Air Force" provides a record of the development of aviation, but even more of the development of a personality. It is a new William Mitchell, and a slightly chastened one, who writes this volume and both literary style and literal accuracy of statement gain by the change.

To be sure, something of the old tendency to broad generalization and generous optimism ignoring exactitude of statement of technical detail, still survives. "Skyways" includes such obviously questionable observations as: "Modern helicopters are able to rise from the ground, and after obtaining a certain altitude, to go in any direction desired." "Airships have almost as much room in them as an ocean steamer, and they go about four times as fast." [In point of fact, the fastest existing airship has somewhat less than three times the speed of a number of Atlantic liners.] "We may look forward to the time when aircraft will be flying through the air equipped with motors whose power is sent them from the ground." "Propellers are also made that can be reversed, *and actually push the airplane backward through the air*." [Italics ours.] "Germany was the first of the great nations to organize a separate department of aviation, which occurred in 1916." [Strictly speaking, Germany did not have during the War, and never has had, independent military aviation.] "Speeds of four hundred miles an hour can be obtained at present." "Airplanes can be built today that will take passengers, mail, and express from New York to San Francisco at the rate of three hundred miles an hour and make it in one jump." The statements made about the most efficient speed of rotation of propellers are so generalized as to be quite inaccurate. I have been unable to check even approximately the author's estimate of the relative costs of fuel for Diesel and gasoline engines. The explanation given of the functioning of the Handley Page automatic slot bears no relation to the fact, General Mitchell asserting that it is actuated by springs, and its effect on landing speed is preposterously overestimated.

"Winged Defense" was published in 1925. A great deal of its content is repeated without very substantial change in "Skyways," and comparison would suggest either that aeronautical progress in five years had been extraordinarily small or that the author had become much more conservative in the interval. Phenomenal achievements in prospect that were "well within the bounds of possibility" in 1925 are dismissed in 1930 with the observation: "While these things seem like fancies from the realms of romance, they are scientifically possible."

Errors of fact may be multiplied, but they do not affect the spirit of the book nor its real interest. It is not in any sense a textbook, and anyone who accepted it as his sole aeronautical authority would gain some very misleading impressions. As a record of personal experience and a personal revelation, however, it rates high. In General Mitchell's stories of hunting by air, of the campaign of 1918 on the Western Front, of the training of military pilots, and of commercial flying in Europe, he is at his best. The chapters on military tactics largely repeat the argument of previous volumes upon the supremacy of air power. Those on the details of administration of air forces are more novel and more conservative. The comments on commercial operation are also conservative in tone on the whole, al-

though in dealing with certain aspects, and especially in writing of air law, the author is clearly out of his depth With all 'Skyways" faults we recommend that you read it—EDWARD P WARNER.

A WAR FLYING NOVEL

CONTACT, *by Elliott White Springs, Sears Publishing Company Inc New York $2.50*

IN THIS book Mr. Springs paints a vivid woed picture of the loves, fights, binges and other varied experiences of most any American who enlisted in the U S Aviation Service but trained and served with the Royal Flying Corp. The book, although claimed to be fiction, contains mention of sufficient instances well known to most every overseas pilot to lead one to believe that once again Mr. Springs has drawn from memory and interwoven the actual facts with bits of fiction Winnie, the principal character, could be any one of hundreds of real men who took off and went west, or came back to forget everything until the next patrol He has "the girl" back home He is scared stiff on his first solo He sees London as only London should be seen in those days He goes to the Front, goes over and doesn't know what it is all about When he does he doesn't give a damn for it doesn't seem to matter He fights hard and plays hard, when he has the chance to play He forgets the girl back home now and then makes friends and sees some of them die It all leaves him a bit hard and he values life just that much less Then he is ordered to an American squadron He fancies that not a bit, and with a bottle in each hand goes A W O L In the mean time the war ends, but by "wangling" things he gets back home The girl seems far too good for him and he goes into a flat spin Finally all is well and the story ends with the wedding bells just ahead

For the most part the story travels swiftly and holds the reader's attention It does drag a bit in places and Winnie's apparent stupidity, particularly after he has returned home, makes one want to jolt him into action Yet on the other hand, Winnie acts no different than did thousands of others just out of the war and Mr Springs gives us a splendid opportunity to see others as others saw us in 1919 and 1920 And yes, perhaps even after that.—R SIDNEY BOWEN JR

FLYING FOR CHILDREN

PLAYING AIRPLANE, *by J F. McNamara, MacMillan Co, 128 pp., $2.50.*

THIS book is announced by the publishers as intended for children from eight to ten years of age It deals among other things with a method of making an imitation airplane cockpit out of a soap box and learning the operation of the controls during maneuvers without leaving the nursery floor There was no one on the staff of AVIATION who felt entirely competent to prepare a review, and the task was therefore turned over to a boy nine years of age, the son of a former Army aviator His review follows, exactly in his own words—ED

Dear Editor

Thank you for sending me the book called "Playing Airplane" I'm glad those children's father wrote this book, because it tells you such a lot. It tells you how to make a pretend airplane, and then, when you are playing in it how to really fly a real one.

The boys in the book, you see, play airplane too and their father goes up with them, in pretend and teaches them all the things real pilots do in flying How to loop-the-loop and bank and get into a tail spin and it makes it awfully exciting because it seems so real And then they have adventures too—all pretend—but there is a fight between reds and the blues, and they bomb the enemy airport—*Pop Bang* in a storm and lots of other things like that, too They cross the Atlantic just like Lindbergh. That makes you kind of anxious but excited all the same. I think the nicest part is the realness of it It is as if—all through the story part you were *really* being taught to fly

If I could go up now again I'd watch the pilot doing things I believe I'd know just why he did them Anyway I want to make a playing-airplane too and look over the side—and I shall not see the floor I shall see ground way below—STEPHEN BALDWIN

The Buyers' Log Book

Navigation Lights

TYPE 554 navigation lights are now being offered by the Pioneer Instrument Co, Brooklyn, N. Y, as a result of several months' investigation of the requirements of the aircraft industry They contain very few parts and may be taken apart by hand The glass lens is held in place by a phosphor bronze snap ring and seats on a soft rubber gasket, which makes the light watertight

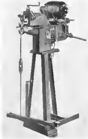
Lights may be mounted vertically on the end of the wing, or horizontally near the end of the wings on the top and bottom surfaces It is usually necessary to mount tail lights vertically on the rudder in pairs Mooring lights are also available Lights are equipped with sockets for double contact lamps of any size up to 32 candlepower Standard sets are sold for both vertical and horizontal mounting, or lights may be purchased singly or in any other combination—AVIATION, *August 1930*

Electric Rotary Machines

TWO models of the "Speed King" electric rotary machine are now offered to the trade by The Peck, Stow & Wilcox Co, Southington, Conn The models are designated No 626 and No 627 with maximum capacity of 18 and 16 gauge respectively These machines are for burring, turning, wiring, elbow edging, crimping, beading, slitting and other special operations

Three speeds are provided, and a foot treadle or crank screw for depressing the upper roll Regular equipment allows for hand operation or foot control of the double friction clutch An electric motor of the repulsion induction type is furnished, a $\frac{1}{4}$ hp motor with No 626 and a $\frac{1}{2}$ hp motor with No 627. Shipping weights are 340 lb and 425 lb respectively

The company also has available at a lower price a small machine No 623, intended for light work This machine has the same variety of rolls as the larger models, is furnished with a $\frac{1}{2}$ hp motor, and has no clutch The weight is 105 lb and the dimensions 23 in x 14 in x 16 in—AVIATION, *August, 1930*



The "Speed King" rotary machine

G. E. Code Beacon

THE General Electric Co. has recently introduced a new electric code beacon which can be used to advantage on airways where the contour of the ground makes it inadvisable to utilize the more expensive rotating beacon On the side of a hill, where a rotating beacon is likely to be obscured from view and directed into the hillside a great part of the time, the electric code beacon flashes its warning in all directions. The signal indication of this beacon is not so powerful as the beam of a rotating beacon.

New Code beacon

The instrument consists mainly of three Fresnel-lens units assembled one above another upon a cast aluminum base The lower lens consists of three sections of a 300-mm lens and the middle lens is similar except that it is made in one piece. It is joined to the lower lens unit by a hinged frame Surmounting the middle lens are a glass dome of the Fresnel type and a small casting to enclose the focusing mechanism of the upper lamp The unit has an outside diameter of 15 in and an overall height of 33 in For installation on airways and for marking obstructions the beacon is equipped with two 200-watt, 110 volt Mazda lamps For airport installation the requirement is two 500-watt Mazda lamps—AVIATION, *August, 1930*

Alumilite

ALUMILITE is a new electrolytic color finish for aluminum and aluminum alloys which was recently placed on the market by Metals Protection Corp Indianapolis, Ind This coating is an integral part of the aluminum itself and will not crack, chip or peel off, according to the manufacturer Unusual resistance is offered to atmospheric and salt water corrosion Alumilite is not recommended, however, for use in protecting aluminum from acids and alkalis, and where its use is contemplated for the prevention of chemical action, specific information should be obtained The melting point is in excess of that of aluminum and a marked increase is also shown in its absorption of heat It will not injure or discolor other articles with which it comes in contact—AVIATION *August, 1930*

Aviation Forms

STANDARDIZED business forms for use in all branches of the aviation industry have been placed on the market by Comfort Printing Specialty Co, 107 North 8th Street, St Louis These include such forms as the aircraft repair order, gasoline and oil consumption reports, student progress reports, airport register, salesman's data book, air mail stickers, employee's time card, requisition form, stock room record card, prospect record card, ground tags and inspection tags Repair orders are available in duplicate or triplicate and, as in the case of a number of other forms, include the printing of the company's name, address and telephone number in red ink—AVIATION, *August, 1930*

Elastic Stop Nut

THE A.G.A. Co of Elizabeth, N J, has recently placed on the market the Elastic Stop Nut which it recommends for aircraft use and other difficult vibratory application This is an ordinary nut with its height increased to incorporate an unthreaded ring of tough, bone-hard vulcanized red fiber. The fiber is held securely in its recess by rolling in the end of the nut. Sizes are carried in stock to fit any commercial thread, and special sizes and materials are obtainable—AVIATION, *August, 1930*

Oildraulic Struts

OILDRAULIC struts are now being manufactured in three standard sizes by the Aircraft Products Corp,

Drawing of the Oildraulic strut

7424 Melville Avenue Detroit. B type is for planes with a gross weight of 1,200 lb, J type for planes of 2,700 lb and S type for planes of 5 200 lb Multiples of these units are used efficiently on planes grossing about the maximum for single units The first landing impact is taken on oil which escapes through check valves, and as the plane settles its weight on the wheels coiled springs supplement the action of the oil. A rebound check prevents bouncing in rough landings.

The Oildraulic struts have been combined with a hydraulic hoist principle to form a hydraulic jack for amphibion landing gear—AVIATION *August 1930*

Sioux Tools

NEW items recently put out by Albertson & Co., Inc Sioux City, Iowa, include Sioux tapered pilots and a valve seat indicator The company states that in motor reconditioning it is now possible to determine just how much a valve seat is out of true through the use of these tools The pilots are precision tools hardened and ground to close limits and Sioux reamers now in use are adaptable to them

Sioux valve seat indicator

The Sioux line includes valve seat reamers, reamer sets, valve face grinding machines, portable electric drills, flexible shafts and attachments and electric bench grinders—AVIATION, *August, 1930*

Radio Dynamotor

A NEW Type A dynamotor for aircraft radio is now being manufactured by the Eclipse Aviation Corp, East Orange, N J., division of Bendix Aviation Corp This is especially developed for radio power of multi engined transport and passenger planes to operate in conjunction with the highest grade radio telephone or telegraph equipment The dynamotor has a rated output of 525 watts and is driven from a 12 volt battery The manufacturer claims that an outstanding feature of this machine is its ability to operate under sustained overloads for long periods of time without any increase in weight over the conventional aviation dynamotor—AVIATION *August 1930*

Trans-Light Roof

A LIGHT transmitting roof for airports, made by Barns Engineering Co Inc, 155 East 42d Street New York City is a recent development of Glass-Steel industrial roof construction

The light transmitting glass areas are in the form of large letters, giving a uniform distribution of illumination throughout the working floor of the hangar in the daytime and causing the name of the airport, manufacturer or transport operator to stand out in sharp relief This feature also identifies a town or airport to pilots flying by night, the ordinary electric lighting of the hangar interior being transmitted through the glass letters.

The roof consists essentially of rolled steel glazme bars supported on the structural steel roof framework furnished by the owner, lights of ¼ in. wire glass supported in beds of elastic glazing compound and secured to the bars by soft lead glass stops, and opaque areas of ¼ in. asbestos sheets of the same dimensions and laid in the same manner as the lights of glass. The opaque areas are coated on the outside with a dark colored, non-reflecting material The lights of glass are 24 in. wide by not over 30 in long—AVIATION. *August 1930*

Side Slips

BY ROBERT R. OSBORN

WE SEE by the papers that the American Air Transport Association has issued a time table of over 200 air lines operating in the United States and are pleased to read that the schedules are liberally sprinkled with asterisks, daggers and very complicated foot notes. This we take as an indication that air transport is really on a sound and substantial basis, for it certainly is a fact that the best railroads have the least understandable time tables We haven't seen one of the new air time tables yet, and, as it may be some time before we do, we are going to take this opportunity of suggesting some conditions and footnotes which would add greatly to the complexity of the tables, and which they may not have included

NOTES

*Plane stops here only on signal, low oil pressure or lack of gas

†This field is only for discharging of passengers as pilot has to keep the ship rolling to get in and out of here

‖Passengers are not allowed to throw out cigarette or cigar butts while passing over Kansas as they cause serious riots among the inhabitants scrambling for them

**Will not run Decoration Day, Labor Day, Independence Day, Christmas Day, Thanksgiving Day, New Years Day, All Saints Day, Bastile Day, Washington's Birthday, Lincoln's Birthday, Sundays or Holidays,—oh well, we don't think we'll bother to run this at all

‡Excursion plane, equipped with racks for shoe boxes, orange and banana skins, and provided with a courier who can trade "smart aleck" remarks with any passenger

"De Luxe Service Yes that's our story and we're sticking to it If you don't think this is De Luxe service try one of our competitor's lines sometime.

††Passengers should not become alarmed at what appears to be a forced landing in the middle of a swamp here The president of the line owns this property and is trying to kid the public into buying lots in the place

***Please do not talk to the crew while the plane is in motion as this is the time they discuss with each other the head winds and bumpy weather they always have on this route, and wonder how the low down Chief Dispatcher holds down his job even though he is the President's son in law

§Ship will pass over either Cleveland or Akron depending on which girl the pilot happens to like better at that time

‡Extra fare will be charged on this line until we make enough to pay for the recent top overhaul of the engines

It might be an idea to have some

RULES FOR PASSENGERS

1 All windows must be kept closed when passing over Pittsburgh

2 Please don't shoot the pilot,—make all complaints about the service to the courier

3 Only passengers with streamlined heads may keep them out of the windows.

4 Please report any discourtesies immediately so that we can all enjoy the joke

5 All children will be carried in the Baggage Compartment

6 Dogs under twelve years of age must be accompanied by parents or guardian

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Readers who have witnessed operations of air lines from the big metropolitan airports, with their uniformed operators, rest rooms, awning covered walkways, and completely upholstered ships have little idea what conditions are out in the great wide open spaces where, as you know, men are men and it's just too bad if you get your six gun tangled in your pants The following report sent in by C F. McR., while on one of his numerous tours, shows that the pilots of these big flossy air lines are just big sissies, stranger, that's what they are—

"I found one line operating in an interesting manner from a field out here They are flying tri-engined planes every day, carrying good loads of passengers and all of them seem happy Every time an airplane wants to take off the mechanic hops into an automobile and drives out onto the field to shoo the cattle off. After he has driven up and down the field for about five minutes, the plane with its load of passengers taxies out through the lane that has been opened up down the center of the herd of long horns and under the telegraph wires which run directly across the field about midway of the runway The pilot goes up on a little hill taking the ship along with him, and then comes thundering down the field across which a stiff cross wind is invariably blowing, unless it is a tail wind He holds his tail high in order to get under the wires before taking off There is no special way of getting between the right two telegraph poles, and anyway he is so busy missing the cows that he doesn't bother much about the poles The airport is at an altitude of 3,500 feet so if there is a tail wind it helps considerably in getting off the ground, and there is always some trouble, although never serious, if the cross wind is blowing instead of the tail wind After the plane is gone the mechanic honks his way through the herd again in order to get back to the hangar and chase the longhorns away from the fabric on the left lower aileron of the spare plane They have eaten all of the rest of the fabric and some of the struts"

If the plane is to take over most of the functions of the railroads think of the many interesting jobs there will be For instance think of the great fun in dropping mail off at the local stations from the mail plane,—aiming from about a thousand feet at the home of some one you'd like to get even with. How would you like to be the pilot of the pusher plane, coupling up with heavily loaded ships unable to climb over some mountains? Imagine the pilot of a milk plane complaining about a rough engine which churned all of his cargo to butter before he reached the end of the trip

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The following item came in from Mr. D J B of Armonk, N Y, marked for the attention of the Intrepid Aviator It was clipped from the New York *Times*, "Three years ago the Army disposed of the old type of 'Jenny' planes that were a product of the World War and were used in training These, together with the war-time Liberty motors that were installed in them, were considered unsafe"

The Intrepid Aviator said he did know of a fellow who put a Liberty in a Jenny and then invited him to go along on a flight test. He said they both put their heads down inside the cowl and pushed the throttle open. There was a roar which gradually died away and they never did find that Liberty engine again.

MANUFACTURERS' SPECIFICATIONS ON ENGINES AVAILABLE FOR COMMERCIAL USE

AVIATION does not assume responsibility for the figures given

MANUFACTURER OR AGENT	Engine	Cooling System	Cylinder Arrangement	No. of Cylinders	Strokes per Cycle	Propeller Drive
Allison Engineering Co	V1410	A	IV-45°	12	4	D
Allison Engineering Co	VG1410	A	IV-45°	12	4	G¹
Allison Engineering Co	V1550	W	IV-45°	12	4	D
American Cirrus Engines	Cirrus Mark III	A	L	4	4	D
American Cirrus Engines, Inc	Cirrus Super ed					
Axelson Aircraft Engine Co	Axelson B7R.	A	Rad	7	4	D
Brownback Motor Lab Inc	C-400	A	Rad S	9	4	
Chevrolair Motors Inc.	D-4	A	L	4	4	D
Comet Engine Corp	Comet	A	Rad	7	4	D
Continental Aircraft Engine Co	A70	A	Rad	7	4	D
Curtiss Aeroplane & Motor Co	OX-5	W	V-90°	8	4	D
Curtiss Aeroplane & Motor Co	OXX6	W	V-90°	8	4	D
Curtiss Aeroplane & Motor Co	C-6A	W	L	6	4	D
Curtiss Aeroplane & Motor Co	D12	W	V-60°	12	4	D
Curtiss Aeroplane & Motor Co	Conqueror	W	V-60°	12	4	D
Curtiss Aeroplane & Motor Co, Inc	Geared Conqueror	W	V-60°	12	4	G²
Curtiss Airplane & Motor Co	Chieftain	A	H	12	4	D
Curtiss Airplane & Motor Co	Challenger	A	Rad S	6	4	D
Dayton Airplane Engine Co	Bear	A	L	4	4	D
General Air Motors Co	Moore 3-Valve	A	Rad	5	4	D
Hallett Mfg Co	H 526	A	Rad	2	4	D
Irwin Aircraft Co	Irwin 79	A	Rad	4	2	D
Jacobs Aircraft Engine Co	Jacobs LA 1	A	Rad	7		D
Kinner Airplane & Motor Corp	K 5	A	Rad	5	4	D
Kimball Aircraft Corp	Beetle Model K	A	Rad	7	4	D
Lambert Aircraft Engine Corp	Velie M 5	A	Rad	5	4	D
Lambert Aircraft Engine Corp	R 266	A	Rad	5	4	D
Le Blond Aircraft Engine Corp	60 Model 5-D	A	Rad	5	4	D
Le Blond Aircraft Engine Co	90 Model 7 D	A	Rad	7	4	D
Le Blond Aircraft Engine Corp	5-DF	A	Rad	5	4	D
Light Mfg and Foundry Co	BrownbackC400	A	Rad	9		D
Lycoming Mfg. Co	R-680	A	Rad	9	4	D
Michigan Aero Engine Co.,	Rover	A	L	4	4	D
Packard Motor Car Co	1A 2775	W	X-60°	24	4	D
Packard Motor Car Co	3A 1800	W	V-60°	12	4	D
Packard Motor Car Co	3A 1800	W	V-60°	12	4	G
Packard Motor Car Co.,	3A 1800	W	V-60°	12	4	D
Packard Motor Car Co	3A-2500	W	V-60°	12	4	D
Packard Motor Car Co	3A 2500	W	V-60°	12	4	G
Packard Motor Car Co,	DR-980	A	Rad	9	4	D
Pratt & Whitney Aircraft Co	Wasp	A	Rad	9	4	D
Pratt & Whitney Aircraft Co	Geared Wasp	A	Rad	9	4	G³
Pratt & Whitney Aircraft Co	Hornet	A	Rad	9	4	D
Pratt & Whitney Aircraft Co	Hornet B	A	Rad	9	4	D
Pratt & Whitney Aircraft Co	Geared Hornet B	A	Rad	9	4	G³
Pratt & Whitney Aircraft Co.	Hornet A	A	Rad	9	4	G³
Pratt & Whitney Aircraft Co	Wasp Junior	A	Rad	9	4	D
Szekely O. E. Corp	SR 3	A	Rad	3	4	D
Warner Aircraft Corp	Scarab	A	Rad	7	4	D
Warner Aeronautical Corp.,	Warrior	A	Rad	7	4	D
Wright Aeronautical Corp	Whirlwind Five	A	Rad	5	4	D
Wright Aeronautical Corp	Whirlwind Seven	A	Rad	7	4	D
Wright Aeronautical Corp	Whirlwind Nine	A	Rad	9	4	D
Wright Aeronautical Corp	Whirlwind J5	A	Rad	9	4	D
Wright Aeronautical Corp	Cyclone R1750	A	Rad	9	4	D
Wright Aeronautical Corp	Gipsy	A	L	4	4	D

*— Engines of foreign manufacture
†— Rebuilt
a— Applied for
A— Air cooled
Aa— Aluminum alloy
Ae— Aeromarine
Al— Aluminum
AS— Ansaal or Scintilla
Au— Automatic
B— Battery ignition
BR— Robert Bosch
Bs— Scintilla booster magneto
C— Cast iron
Ch— Champion
Cylinder Construction
first—head
second—walls on waterjacket
third—sleeve if any
D— Direct
De— Delco
Du— Duplex
Dr— Dixie
DM—Dual Magneto
Ec— Eclipse
E— Ensign
Ex— Extra
G— Geared
G¹— 5 3 epicyclic gear
G²—2 1 reduction gear
G³—3 2 reduction gear
GE— General Electric
H— Hexagonal
Hd—Heywood
Hy— Holley
I— Inverted
I— Cast Iron
L— Cylinders in line
Mo— Monel
M— Magnetic
NI— Nickel Iron
N— No
Op— Optional
O— Own
Ohc— Overhead cam
prr— Push rods and rocker arms
Rad— Radial
Rad S— Staggered Radial
S A E.—S A E. Mounting
Sc— Scintilla
Sd— Scintilla—Dual Magneto
Sg— Stromberg
Sg¹— Stromberg NA U5 duplex
Sg²— Stromberg NAS-6E
Sm— Sum
So— Solex
Sp— Splitdorf
S— Steel
U— U&L Electric
V— Vee
W— Water cooled
Wi— Winfield
X— Extra
Y— Yes Z—Zenith

SPECIFICATIONS OF AMERICAN COMMERCIAL AIRPLANES

Including only planes with Approved Type Certificates—AVIATION does not assume responsibility for the figures given

Manufacturer	Designation	A.T.C. No.	Price at Factory	Type	No. of Seats	Span	Length Overall	Height Overall	Make Engine	Total Rated Hp.	R.p.m. at Rated Hp.	Fuel Cap. (Gal.)	Normal Range	Fuel Consumption at Cruising Speed Gal. per Hr.	Make of Prop.
		GENERAL							POWER PLANT						
Aeromarine Klemm Corp	AKL-25-A	121	3,350	OML	2	40' 2"	24' 6"		Salmson	40	[illegible]	15			Aero
Aeromarine Klemm Corp	AKL-26-A	204	3,220	OML	2	40' 2"	25' 6"		LB	65	[illegible]	29			Aero
Aeromarine Klemm Corp	AKL-26-B	334	3,200	OML	2	40' 2"	23' 1"		LB	85	2,12[illegible]	29			Aero
Alexander Aircraft Co	Eaglerock A-2	50	2,000	OBL	2	36' 8"	24' 11"	9' 11"	OX-5	90	[illegible]	5[illegible]	460	7.2	W. Sa
Alexander Aircraft Co	Eaglerock A-12	136	5,242	OBL	2	36' 8"	24' 2"	9' 10"	Co	120	[illegible]	5[illegible]	625	8.0	S
Alexander Aircraft Co	Eaglerock A-15	160	3,807	OBL	3	36' 8"	25' 11"	9' 10"	K	90	1,720	2[illegible]	350	6.0	W. Sa
Alexander Aircraft Co	A-13	141	3,850	OBL	3	36' 8"	24' 2"	6' 10"	Cu Ch	170	1,800		655	6.0	S
Alexander Aircraft Co	C-3 Bullet	518	2,200	OML	4	36'	26' 10"	7' 6"	Ww	162	2,000	41	560	6.0	S
Alexander Aircraft Co	A-1	57	*2,250	OBL	3	36' 8"	22' 11"	6' 10"	Ww	222	1,200	59	290	11.0	S
American Aeronautical Corp	S-56	282	7,372	OBA	3	34' 1"	25'	10' 1"	K	100	1,860	2[illegible]	250	7.0	P
American Eagle Aircraft Co	220	116	4,765	CML		37'	24'	8'	K	100	1,820	2[illegible]	400	8.2	Su
American Eagle Aircraft Co	251	202	5,795	OBL	3	21'	23' 5"	8' 4"	Wr Ww	162	1,820	60	520	9.0	S
American Eagle Aircraft Co	D-420	301	6,395	CLM	4	41'	24' 7"	8' 1"	Wr Ww	162	1,850	60	200	9.0	S
American Eagle Aircraft Co	C-420	320	5,972	CML	4	41'	24' 7"	8' 1"	[illegible]	162	1,830	60	200	9.0	S
American Eagle Aircraft Co	201	262	3,662	OBL	3	31' 1"	22' 11"	8' 2"	K	100	1,830	26	425	8.2	S
Arrow Aircraft & Motors Corp	A2 60	112	3,131	OBL		25' 10"	16' 5"	7' 5"	Lb	60	1,620	16	200	6.0	Hr
Bach Aircraft Co	3-CT-8	122	59,500	CML	10	28' 2"	36' 10"	10'	Pwh 2 Ww	822	1,900	200	222	42.0	HSt
Bach Aircraft Co	3-CT-6	271	36,500	CML	10	28' 5"	36' 10"	9' 6"	Pww 2 Ww	825	1,900	200	525	42.0	HSt
Bellanca Aircraft Corp	Pacemaker	129	14,620	CML	6	46' 4"	27' 10"	8' 4"	Wr Ww	300	2,000	112	950	16.0	HSt
Bellanca Aircraft Corp	CH-300 Seaplane	129	18,000	CMZ	6	46' 4"			Wr Ww	300	2,000	11[illegible]	700	16.0	HSt
Bellanca Aircraft Corp	Freighter	24[illegible]	15,050	CML	4	48' 4"	27' 10"	8' 4"	Wr Ww	300	2,000	85	620	16.0	HSt
Bellanca Aircraft Corp	Pacemaker	328	15,430	CML	6	46' 4"	27' 10"	8' 4"	Pwj	200	2,000	112	820	16.0	HSt
Bellanca Aircraft Corp	Skyrocket	516	17,000	CML	6	46' 4"	29' 9"	8' 4"	Pww	420	2,000	115	65[illegible]	22.0	HSt
Brunner-Winkle Aircraft Corp	Bird, Model A	101		OBL	3	34'	22' 8"	8'	OX-5	60	1,400	42	[illegible]	7.0	W. Su
Brunner-Winkle Aircraft Corp	Bird, Model B	236		OBL	3	34'	22'	8'	K	60	1,822	35	222	6.0	HSt
Buhl Aircraft Co	CA-8-A	68	19,500	CQL	8	48'	36'	10'	Cy	523	1,600	181	222	26.0	HSt
Buhl Aircraft Co	CA-8-B	99	19,500	CQL	8	48'	36'	10'	Pwh	525	1,900	181	275	26.0	HSt
Buhl Aircraft Co	CA-6	128	12,200	CQL	6	40'	26' 8"	8' 7"	Wr Ww	300	2,000	108	22[illegible]	16.0	HSt
Buhl Aircraft Co	CA-3-D	163	12,000	CQL	3	26'	28'	8'	Wr Ww	300	2,000	90	70[illegible]	16.0	HSt
Cessna Aircraft Co	DC-6-A	242	11,000	CML	4	40' 8"	27' 11"	7' 8"	Wr Ww	300	2,000	6[illegible]		13.0	Sa H
Cessna Aircraft Co	DC-6-B	244	9,720	CML	4	40' 8"	27' 11"	7' 8"	Wr Ww	223	2,000	66		11.0	Su H
Command-Aire Inc	3-C-3A	118	4,622	OBL	3	32' 6"	24' 2"	8' 4"	War	110	1,850	44	500	7.0	H, Sa
Command-Aire Inc	5-C-3 Ch	184	2,600	OBL	3	31' 5"	24' 6"	8' 4"	Cr Ch	170	1,800	55	650	8.0	HSt
Command-Aire Inc	5-C-2 Ax	214	5,000	OML	3	31' 5"	24' 1"	8' 4"	Ax	120	1,800	51	720	7.5	Su H
Command-Aire Inc	5-C-3-C	233		OBL	3	31' 5"	24' 6"	9' 6"	Wr Ww	165	2,000	55	730	7.5	HSt
Command-Aire Inc	3-C-3-A	151	4,675	OBL	3	21' 4"	24' 5"	6' 6"	Wrr	110	1,8[illegible]	46	500	5.5	W, Su
Consolidated Aircraft Co	Commodore	258		CMF	23	100'	61' 6"	15' 0"	2 Pwh	1,150	1,92[illegible]	62[illegible]	1,0[illegible]	62.0	StS
Consolidated Aircraft Co	Model 17, Type 1	261		CM	8	45'	31' 9"	6' 2"	Pwh	272	1,920	120	500	32.2	HSt
Consolidated Aircraft Co	Model 20, Type 2	320		CM	6	42'	31' 9"	10' 7"	Pwh	522	1,950	15[illegible]	200	32.5	HSt
Corner Monoplane Co	PB-1	282	5,750	CML	3	37'	27'		K	90	1,825				
Crown Motor Carriage Co	Custombilt B-3	199	4,072	OBL	2	28'	21' 6"	8' 6"	K	80	1,8[illegible]	22	400	8.0	Sy, H
Cunningham-Hall Aircraft Corp	PT-6	177	13,000	CBL	6	41' 8"	28' 6"	9' 11"	Wr Ww	300	2,000	9[illegible]	700	15.0	HSt
Curtiss-Wright Corp															
Curtiss Aeroplane & Motor Co	Carrier Pigeon	237		OBL	1	47' 8"	34' 0"		Cu Cg	600	2,[illegible]				Ca Re
Curtiss Aeroplane & Motor Co	Fledgling Ch	191		OBL	3	39' 5"			Cu Ch	170	[illegible]	40			
Curtiss Aeroplane & Motor Co	Fledgling K2	269		OBL	3	39' 5"			K	90	1,82[illegible]	40			
Curtiss Aeroplane & Motor Co	Condor	103		CBL	21	91' 8"	57' 1"	16' 6"	2 Cu Cg	1,200	2,[illegible]	278			Cu Re
Curtiss-Robertson Airpl. Mfg. Co	Robin OX-5	88	2,495	CML		41'	22' 9"	7' 10"	OX-5	80	1,400	30	283	7.0	Hr
Curtiss-Robertson Airpl. Mfg. Co	Robin C-1	143	5,995	CML		41'	23' 1"	8'	Cu Ch	185	1,800	50	600	10.9	Cu Re
Curtiss-Robertson Airpl. Mfg. Co	Robin J-1	228	5,995	CML		41'	23' 6"	8'	Wr Ww	162	2,000	50	800	15.1	HSt
Curtiss-Robertson Airpl. Mfg. Co	Thrush	201	12,000	CML	6	48'	32' 6"	9' 5"	Wr Ww	240	2,000	11[illegible]	905	10.9	Cu Re
Keystone-Loening Aircraft Corp	Air Yacht	90		CBA	8	46' 8"	34' 8"	15' 2"	Wr Cy Pwh	222	1,900		525	20.0	HSt
Keystone-Loening Aircraft Corp	Commuter	210	16,000	CBA	4	40'	32' 1"	15' 8"	Wr Ww	200	2,000	2[illegible]	400	15.0	HSt
Keystone-Loening Aircraft Corp	Patrician	260		CML	20	86' 6"	61' 2"	13' 4"	3 Cy 3 Pwh	1,272	1,900	53[illegible]			HSt
Moth Aircraft Corp	Gipsy Moth 60GM	107	3,000	OBL	2	30'	23' 11"	8' 9"	Wr Gy	82	1,900	35	3[illegible]	7.8	Gar
Travel Air Mfg. Co	A-6000-A	118	16,500	CML	8	54' 5"	31' 2"	9' 2"	Pww	420	2,000	120	700	2[illegible].0	HSt
Travel Air Mfg. Co	6000-B	130	13,200	CML	6	48' 8"	31' 2"	9' 3"	Wr Ww	300	2,000	90	520	18.0	HSt
Travel Air Mfg. Co	E-4000	189	6,422	OBL	3	33'	24' 1"	8' 11"	Wr Ww	162	2,000	67	625	10.0	HSt
Travel Air Mfg. Co	4-D	234	2,960	OBL	3	33'	25' 4"	9' 1"	Wr Ww	225	2,000	67	500	14.0	HSt
Davis Aircraft Corp	D-1	226	2,985	OML		30' 3"	19' 10"	7'	Lb	60	1,850	20	320	4.5	Hs
Davis Aircraft Corp	D1-K	272	3,002	OML		30' 3"	20' 4"	7'	K	100	1,820	23	350	6.5	Hr
Davis Aircraft Corp	D1-100	317	3,595	OML		30' 3"	21' 8"	7'	Lv-85	85	2,125	20	3[illegible]	5.0	Hr
Detroit Aircraft Corp															
Eastman Aircraft Corp	E-2 Sea Rover	288	8,085	OBF	4	38'	26' 5"	8' 9"	Ca Ch	170	[illegible]	4[illegible]	407	10.6	HSt
Lockheed Aircraft Co	Air Express	102	10,985	CML		43'	27' 6"	9' 8"	Pww	420	1,90[illegible]	1[illegible]	750	20.0	HSt
Lockheed Aircraft Co	Vega Model 5B	222	10,985	CML	2	41'	27' 6"	8' 4"	Pww	425	1,800	67	515		HSt
Lockheed Aircraft Co	Sirius	206	16,985	OML		42' 10"	27' 6"	9'	Pww	450	2,100				
Parks Air College, Inc	P-1	179		OBL		28' 8"	24' 7"	9' 4"	OX-5	90	1,40[illegible]	55	5[illegible]	10.0	Hr
Ryan Aircraft Corp	B-5	142	12,985	CML		42' 4"	27' 11"	9' 10"	Wr Ww	300	2,0[illegible]	1[illegible]	[illegible]	15.0	HSt
Ryan Aircraft Corp	B-7	262	16,985	CML	6	42' 4"	29' 11"	9' 9"	Pww	425	1,800	100	500	23.0	HSt
Doyle Aero Corp	O-2	247	2,985	OML	2	30'	19'		Lb	60	1,82[illegible]	2[illegible]	423	5.0	Hr
Driggs Aircraft Corp	Skylark	305	3,485	OLB		28' 5"	21' 6"	8'	Rover	72	1,97[illegible]	17	70	5.0	Hs
Fairchild Aviation Corp	42	242	12,900	CML	4	45' 0"	30' 6"	9' 2"	Wr Ww	300	2,000	10[illegible]	330		HSt
Fairchild Aviation Corp	71 A	289	18,900	CML	7	50'	32' 11"	9' 4"	Pww	420	[illegible]	14[illegible]	050		HSt
Fairchild Aviation Corp	KR-34A	162	6,375	OBL	3	30'	23' 9"	8' 3"	Wr Ww	165	2,000	30		10.0	HSt
Fairchild Aviation Corp	KR-21	213	4,373	OBL		22'	22' 1"	9'	K	90	1,813	25		8.0	Hr Su
Fleet Aircraft Inc	Model I	122		OBL		28'	20' 9"	7' 10"	War	110	1,830	24	350	8.0	Hr
Fleet Aircraft Inc	Model II Seaplane	151		OBZ	2	28'			K	110	1,950	24	319	6.3	HSt
Fleet Aircraft Inc	Model II	152		OBL		28'	20'	7' 10"	K	110	1,825	24	33[illegible]	8.0	Hr
Fokker Aircraft Corp	AF-10A	98	67,500	CML	14	79' 3"	50' 7"	12' 9"	3 Pww	1,200	2,000	360	783	57.0	HSt
Fokker Aircraft Corp	A Universal	104	13,002	CML		47' 9"	33' 6"	8' 0"	Wr Ww	300	2,000	70	522	73.3	HSt
Fokker Aircraft Corp	AF-11A	222	42,000	CMA		59'	43' 10"	14' 5"	Pah Cy	373	1,920	120	425	28.0	HSt
Fokker Aircraft Corp	AF-14	234	28,200	CML		59'	43' 4"	12' 11"	Pwh	525	1,900	10[illegible]	800	27.0	HSt

See page 124 for key

SPECIFICATIONS OF AMERICAN COMMERCIAL AIRPLANES

Including only planes with Approved Type Certificates—AVIATION does not assume responsibility for the figures given

Manufacturer	Designation	A.T.C. No.	Price at Factory	Type	No. of Seats	Span	Length Overall	Height Overall	Make Engine	Total Rated Hp.	R.p.m. at Rated Hp.	Fuel Cap. (Gal.)	Normal Range	Fuel Consumption at Cruising Speed Gal. per Hr.	Make of Prop.
		GENERAL							POWER PLANT						
Fokker Aircraft Corp	AF-32	281	110,000	CML	32	[illegible]	70' 2"	16' 2"	4 Pwh	2,200	1,920	700	850	112	HSt
Fokker Aircraft Corp	Super Universal	52	21,800	CML	8	50' 8"	36' 11"	9' 1"	Pww	420	2,000	120	255	21	HSt
Ford Motor Co	4-AT-E	132	40,000	CML	14	74'	49' 10"	11' 9"	3 Wr Ww	900	2,000	231	370	42	HSt
Ford Motor Co	5-AT-C	165	50,000	CML	17	77' 10"	49' 10"	12'	3 Pww	1,290	2,000	227	510	60	HSt
Ford Motor Co	7-AT	246	47,000	CML	15	77' 10"	49' 10"	12'	2Wr Ww Pww	1,140	2,000	281	612	20	HSt
Ford Motor Co	5-AT-C-S	296	60,000	CMZ	15	77' 10"	51' 4"	14' 6"	3 Pww	1,260	2,000	277	460	60	HSt
General Airplane Corp	Aristocrat	117	4,250	CML	3	36' 4"	25' 4"	7' 9"	Wrr	110	1,850	42	600	5.0	HSt
General Airplanes Corp	Aristocrat 102-E	210	5,25[illegible]	CML	3				Wa	162					
General Airplanes Corp	Cadet 111-C	22[illegible]	4,[illegible]	OML	2				War	110					
Great Lakes Aircraft Corp	2T-1A	228	3,1[illegible]	OBL	2	26' 8"	20' 4"	7' 11"	Cir	90	2,100	2[illegible]	270	6	Hr H
Inland Aviation Co	R-400	259	[illegible]	GML	2	30'	20'	7' 7"	Lb	62	1,650	24	[illegible]		Su
Ireland Aircraft Inc	N-2-B	153	18,000	CBA	4	40'	31'	12' 2"	Wr Ww	300	2,000	90	450	15.0	HSt
Ireland Aircraft Inc	N-2-C	260	23,000	CBA	5	40'	31'	12' 2"	Pww	420	2,000	9[illegible]	450	18.0	HSt
E. M. Laird Airplane Co	LC-R-300	176	11,500	OBL	3	34'	23' 9"	9' 3"	Wr Ww	500	2,000	76	220		HSt
E. M. Laird Airplane Co	LC-RJ-200	152	9,500	OBL	3	28' 0"	22' 9"	9' 3"	Wr Ww	220		76	600		HSt
Lincoln Aircraft, Inc	PT	181	2,[illegible]	OBL	2	32' 3"	22' 7"	8' 10"	OX-5	90	1,400	30	300	8.0	Hr Su
Lincoln Aircraft, Inc	PT K	276	3,862	OBL	3	32' 3"	22' 7"		K	90	1,822		400		Sa
Lincoln Aircraft, Inc	PT W	2[illegible]	4,313	OBL	2	32' 3"	25' 3"		War	110	1,820		400		Sa
Mercury Aircraft Inc	Chic	252	3,680	OML	2	35' 8"	25'	8' 7"	Lb	63	2,030	20	275	7	Hs
Metal Aircraft Corp	G-2-W	19[illegible]	21,000	CML	8	50'	32' 6"	9' 0"	Pww	425	1,900	140	200	22.0	HSt
Mohawk Aircraft Corp	M-1-CK Pinto	26[illegible]	4,000	OML	2	34' 11"	24' 2"	7' 7"	K	90	1,822	57	400	6.0	Hs
Mohawk Aircraft Corp	M-1-CW Pinto	26[illegible]	5,100	OML	2	34' 11"	24' 2"	7' 7"	War	110	1,820	57	400	9.0	Hr
Mono Aircraft Corp	Monoprep	21[illegible]	2,832	CML	2	32'	21'		Lam	55	2,[illegible]				
Mono Aircraft Corp	Monosport	2[illegible]	5,250	CML	2	32' 2"	21' 3"		K	90	1,825				
Mono Aircraft Corp	Monocoupe	222	8,220	CML	4	38'	26' 9"		Wr Ww	225	2,[illegible]				
New Standard Aircraft Corp	D-29-A	216	3,121	OBL	2	30' 6"	24' 3"	6' 0"	K	100	1,[illegible]	2[illegible]	287	7	Hr
New Standard Aircraft Corp	D-25-A	224	2,660	OBL	5	45'	26' 8"	10' 2"	Wr Ww	225	2,000	6[illegible]	200	12	P, Su
Nicholas-Beazley Airplane Co., Inc	Barling NB-3	124	3,900	OML	3	32' 9"	21' 11"	7' 3"	Lb	60	1,650	[illegible]	380	4.2	W
Nicholas-Beazley Airplane Co., Inc	Barling NB-3Y	2[illegible]	3,600	OML	3	32' 9"	22' 3"	7' 3"	Lam	70	2,200	[illegible]	380	4.2	W
Nicholas-Beazley Airplane Co., Inc	Barling NB-3G	231	3,600	OML	3	32' 9"	22' 5"	7' 3"	Ge	90	2,200	[illegible]	400	4.5	W
Ogden Aeronautical Corp	Osprey	33[illegible]	18,000	CLM	6	50'	34' 6"	9' 3"	(3) Cir	270	2,000	60	500	18	HSt
Paramount Aircraft Corp	Cabinaire 162	26[illegible]	6,750	CBL	4	33' 2"	24' 2"	9'	Wr Ww	162	2,000	50	400	12.0	HSt
Pheasant Aircraft Co., Inc	H-10	[illegible]	2,862	OBL	3	32' 6"	23' 6"	9'	OX-5	60	1,400	56	400	9.0	Hs
Pitcairn Aircraft Inc	PA-7-S	1[illegible]	8,000	OBL	3	33'	23' 9"	6' 8"	Wr Ww	222	1,800	7[illegible]			HSt
Rearwin Airplanes Inc	2000-C	222	6,720			35'	25'	9' 11"	Cr Ch	170		55			S
Rearwin Airplanes Inc	2000-CO	314	6,200			35'	22'	9' 11"	Con	162		5[illegible]			S
Simplex Aircraft Corp	Red Arrow K-2-S	43	3,662	OML	2	34' 2"	22' 0"		K	90	1,825	44			W
Simplex Aircraft Corp	Red Arrow W-2-S	238	4,495	OML	2	34' 2"	22' 0"		War	110	1,850	4[illegible]			W
Spartan Aircraft Co	C-3-165	195	5,075	OBL	3	32'	23' 10"	8' 10"	Wr Ww	165	2,000	65	600	10	H
Spartan Aircraft Co	C-3-225	206	7,750	OBL	3	32'	23' 3"	8' 10"	Wr Ww	222	2,000	66	49[illegible]	13	H
Spartan Aircraft Co	C-3-166	200	5,675	OBL	3	32'	25' 4"	8' 10"	Co	165	1,800	65	550	10	H
Spartan Aircraft Co	C4-225	310	9,750	CML	4	50'	31' 8"	9'	Ww	222	2,000	85	700	11.5	H
Star Aircraft Co	Cavalier C	225	2,085	CML	2	31' 6"	19' 0"	6' 4"	Lb	60	1,950	22	400		W
Star Aircraft Co	Cavalier E	221	3,420	OLM	2	31' 6"	20' 1"	6' 6"	Lam				400		W. Su
Stinson Aircraft Corp	SM-6-B	217	15,995	CML	8	52' 8"	34' 4"	10'	Pww	425	1,930	110	575	22.0	HSt
Stinson Aircraft Corp	SM-8-B	294	8,495	CML	4	41' 8"	29' 4"	8' 9"	Wr Ww	223	2,000	65	575	12.2	HSt
Stinson Aircraft Corp	Detroiter	13	10,995	CML	6	47' 1"	32' 8"	8' 11"	Ww	300	2,000	90	825	20.0	HSt
Stinson Aircraft Corp	SM-8-A Jr	29[illegible]	5,775	CML	4	41' 8"	28' 11"	8' 9"	Ly	215	2,000	6[illegible]	800	11.0	HSt
Stinson Aircraft Corp	SM-7-A	29[illegible]	10,492	CML	4	41' 8"	31'	8' 8"	Wr Ww	300	2,000	[illegible]	450	20.0	HSt
Stinson Aircraft Corp	SM-7B	329	10,895	CML	4	41' 7"	30' 11"	8' 9"	Pwj	300	1,950	[illegible]	450	20	HSt
Stinson Aircraft Corp	SM-8D	312	8,995	CML	4	41' 8"	28' 10"	8' 9"	Diesel	225	1,900	5[illegible]	500	11	HSt
St. Louis Aircraft Corp	Cardinal C-2-110	272	3,085	CML	2	32' 4"	21' 5"	7'	K	80	1,822	[illegible]	450	8	Hr Su
St. Louis Aircraft Corp	Cardinal C-2-90	264	3,750	CML	2	32' 4"	21' 5"	7'	Lb	80	1,950	[illegible]	422	7	Hr Sr
St. Louis Aircraft Corp	Cardinal C-2-63	222	3,250	CML	2	32' 4"	21' 3"	7'	Lb	65	1,950	25	350	5	Hr Su
Swallow Airplane Co	T P	105	2,870	OBL	2	30' 11"	22' 2"	8' 10"	OX-5	90	1,400	28	300	8.0	W
Swallow Airplane Co	F-28-Ax	123		OBL	3	32' 8"	22' 7"	8' 7"	Ax	150	1,800	8[illegible]	800	8.0	Ho
Swallow Airplane Co	TP K	186		OBL	3	30' 11"	24' 1"	8' 10"	K	90	1,825	2[illegible]	550	7.5	Su
Swallow Airplane Co	TP W	225		OBL	3	30' 11"	22' 0"	8' 10"	Wrr	110	1,850	2[illegible]	550	7.5	Su
Texas Aero Corp	Temple	45		OML		58' 4"	25' 10"	8' 5"	Wr Ww	200	2,000				
United Aircraft and Transport Corp															
Boeing Airplane Co	100	133	20,500	OBL	1	30'	20' 8"	9' 7"	Pww	420	1,600	97	325	20.0	H
Boeing Airplane Co	204	157		CBF	5	59' 8"	22' 0"	12'	Pww	450	1,900	80	350	20.0	Me
Boeing Airplane Co	40-B-4	183		CBL	4	44' 2"	33' 4"	11' 9"	Pwh	525	1,900	140	450	25.0	Me
Boeing Airplane Co	80-A	206		CBL	18	80'	55'	15' 2"	3 Pwh	1,275	1,900	400	500	80.0	Me
Hamilton Metalplane Co	H-45	85	24,200	CML	8	54' 5"	32' 0"	9' 4"	Pww	422	1,900	140	675	23.0	HSt
Hamilton Metalplane Co	H-47	94	28,000	CML	8	54' 5"	33' 2"	9' 4"	Pwh	525	1,900	140	660	24.0	HSt
Sikorsky Aviation Corp	S-38	126		CQA	12	71' 8"	45'	13' 10"	2 Pww	850	1,900	264	700	44.0	HSt
Stearman Aircraft Co	LT-1	187	25,000	CBL	5	48'	32' 6"	12' 6"	Pwh	525	2,000	142	720	23.0	HSt
Stearman Aircraft Co	C-3-R	221	8,500	OBL	3	35'	24' 11"	8' 8"	Wr Ww	225	2,000	68	680	10.0	HSt
Stearman Aircraft Co	4-E	292	10,000	OBL		38'	26' 4"	10' 2"	Pww	420	2,000	10[illegible]	620		HSt
Stearman Aircraft Co	4-C	304	12,300	OBL	3	38'	26' 11"	10' 2"	Wr Ww	300	2,000	10[illegible]	730		HSt
Stearman Aircraft Co	4-D	305	12,300	OBL	3	38'	26' 11"	10' 2"	Pwj	300	2,000	10[illegible]	710		HSt
Verville Aircraft Co	Sport Trainer	325	5,220	OBL	2	31'	24' 2"	8' 9"	Con.	165	2,000	36	350	9.0	HSt
Verville Aircraft Co	104-9	271	11,000	CML	4	41'	28' 8"	9' 3"	Diesel	225	2,000	60	850	7.0	HSt
Viking Flying Boat Co	Kittyhawk B-2	134	4,230	OBL	3	28'	22' 6"	8' 8"	Y	105	1,210	35	300	6	Hs
Viking Flying Boat Co	Kittyhawk B-4	1[illegible]	4,050	OBL	3	28'	22' 6"	8' 8"	K	90	1,800	33	300	6	Hs
Waco Aircraft Co	90	13	2,582	OBL	3	30' 6"	23' 6"	9'	OX-5	90	1,400	37	425	7.5	Hr
Waco Aircraft Co	165	1[illegible]	6,320	OBL	3	30' 8"	23'	9'	Wr Ww	162	2,000	63		10	Hr
Waco Aircraft Co	225 rtr. w	240	7,335	OBL	3	30' 8"	22' 6"	9' 2"	Wr Ww	225	2,000	65	300	12	Hs
Waco Aircraft Co	225 top. w	257	6,325	OBL	3	30' 3"	22' 8"	9'	Wr Ww	225	2,000	63	300	12.0	HSt
Waco Aircraft Co	Model F W	311	4,220	OBL	3	29' 8"	20' 8"	8' 4"	War	110	2,000	32	423	7.0	Hr
Waco Aircraft Co	Model F K	312	4,100	OBL	3	29' 8"	20' 8"	8' 4"	K	90	1,800	32	400	7.0	Hr
Warrior Aircraft Corp	Argo	178	4,300	OBL	2	28' 8"	20' 8"	9' 1"	Hw	115	1,922	35	425	8.0	HSt

See page 124 for key

SPECIFICATIONS OF AMERICAN COMMERCIAL AIRPLANES

Including only planes with Approved Type Certificates—AVIATION does not assume responsibility for the figures given

Manufacturer	Wing Loading (Lb. per Sq. Ft.)	Power Loading (Lb. per H.P.)	Weight Empty with Water in Water Cooled Engine (Lb.)	Pay Load (Lb.)	Gross Weight (Lb.)	Spars: Material	Spars: How Fabricated—Section	Ribs: Material	Ribs: How Fabricated	Wing Covering: Material	Wing Covering: How Attached	Framework: Material	Framework: How Fabricated	Fuselage Covering: Material	Fuselage Covering: How Attached	Cockpit Dimensions	Cabin Dimensions	Minimum Headroom	Vol. Baggage Comp.
Aeromarine 25-A	6.3	33.1	815	239	1,325	W	Box	W	Ply	W	Ply	W	[illegible]	Fab	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Aeromarine, 26-A	7.37	24.5	1,025	206	1,590	W	Box	W	Ply	W	Ply	W	[illegible]	Fab	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Aeromarine, 26-B	7.54	18.6	1,016	206	1,581	W	Box	W	Ply	W	Ply	W	[illegible]	Fab	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Alexander Eaglerock A-2	7.40	27.1	1,459	340	2,442	W	Lmd. I	W	Trs	Fab	Ta	ST	W	Fab	Te	28x42			
Alexander Eaglerock A-12	7.03	17.2	1,685	340	2,583	W	Lmd. I	W	Trs	Fab	Ta	ST	W	Fab	Te	28x42			
Alexander Eaglerock A-15	7.45	24.4	1,539	340	2,456	W	Lmd. I	W	Trs	Fab	Ta	ST	W	Fab	Te	28x42			
Alexander Eaglerock A-13	7.[illegible]	14.49	1,711	340	2,600	W	Lmd. I	W	Trs	Fab	Ta	ST	W	Fab	Te	28x42			
Alexander Eaglerock Bullet	13.3	16.9	1,720	610	2,780	W	Lmd Box	W	Trs	Fab	Ta	ST	W	Fab	Te		4'x41"	4	4.0
Alexander Eaglerock A-1	7.55	12.46	1,705	340	2,491	W	Lmd. I	W	Trs	Fab	Ta	ST	W	Fab	Te	28x42			
American Aeronautical S-56	7.5	21.5	1,425	365	2,150	Sp	G, Box	Sp	G	Fab	Se	W	Sod Bx	Ply	Scd	3'x4'6"			
American Eagle 330			1,320	425	2,105	W	Ro	W	ST	Fab	Ta	ST	W	Fab	Ta				
American Eagle 251			1,652	527	2,669	W	Ro	W	ST	Fab	Ta	ST	W	Fab	Ta				
American Eagle 201			1,165	366	1,956	W	Ro	W	ST	Fab	Ta	ST	W	Fab	Ta				
American Eagle D-430			1,864	558	2,997	W	Ro	W	ST	Fab	Ta	ST	W	Fab	Ta				
American Eagle C-430			1,875	550	3,008	W	Ro	W	ST	Fab	Ta	ST	W	Fab	Ta				
Arrow A2-60 L	7.35	1[illegible].5	980	170	1,344	W	G	W	G	Fab	Se	ST	W	Fab	Se	34x38			
Bach 3-CT-8	14.9	[illegible]	4,785	1,570	8,030	W	G, Box	Ply	G	Fab	Se	W	G. Bo	Ply	Se	40x46	46x11'	5'	30.0
Bach 3-CT-9	14.9	8.9	5,010	1,525	8,000	W	G, Box	Ply	G	Fab	Se	W	G. Bo	Ply	Se	40x46	46"x11'	5'	30.0
Bellanca Pacemaker			2,363	1,042	4,300	Sp	Sol	Sp	G	Fab	Se	ST	W	Fab	Se			57"	12.0
Bellanca CH-300 Seaplane			2,863	1,042	4,300	Sp	Sol	Sp	G	Fab	Se	ST	W	Fab	Se			57"	12.0
Bellanca Freighter			2,290	1,578	4,600	Sp	Sol	Sp	G	Fab	Se	ST	W	Fab	Se			57"	46.0
Bellanca Pacemaker			2,455	993	4,300	Sp	Sol	Sp	G	Fab	Se	ST	W	Fab	Se			57"	12.0
Bellanca Skyrocket			2,610	1,076	4,600	Sp	Sol	Sp	G	Fab	Se	ST	W	Fab	Se			57"	12.0
Brunner Winkle Bird A	8.1	24.1	1,300	456	2,158	W	[illegible]	W	[illegible]	Fab	Se	ST	W	Fab	Se				
Brunner Winkle Bird Model B	7.5	32.8	1,198	401	1,949	W	[illegible]	W	[illegible]	Fab	Se	ST	W	Fab	Se				
Buhl CA 8	13.02	12.[illegible]	3,542	1,396	5,900	Sp	Box S	Sp	G	Fab	Se	ST	W	Fab	Se		15'x44"	4' 7"	50.0
Buhl CA 6B	13.03	13.4	3,542	1,396	5,900	Sp	Box S	Sp	G	Fab	Se	ST	W	Fab	Se		15'x44"	4' 7"	50.0
Buhl CA-6	13.15	1[illegible]	2,478	1,192	4,600	Sp	Box S	Sp	G	Fab	Se	ST	W	Fab	Se		11'6"x43"	4' 7"	24.0
Buhl CA-3-D	13.15	[illegible]	2,620	413	3,200	Sp	Box S	Sp	G	Fab	Se	ST	W	Fab	Se		10'6"x32"x42"		14.0
Cessna DC-6-A	11.81	14.1	1,452	536	2,260	Sp	[illegible]	Sp	G	Fab	Se	ST	W	Fab	Te	30x40	34"x42"		18.0
Cessna DC-6-B	11.57	15.78	1,471	61	2,260	Sp	[illegible]	Sp	G	Fab	Se	ST	W	Fab	Te	30x40	38"x42"		10
Command-Aire 3-C-3A	7.2	19.5	1,282	390	2,147	Sp	[illegible]	Sp	G	Fab	Se	ST	W	Fab	Se	30x33			4
Command-Aire 3-C-3 Ch.	7.21	14.2	1,404	34	2,300	Sp	[illegible]	Sp	G	Fab	Se	ST	W	Fab	Se	30x33			6
Command-Aire 3-C-3 AX	7.21	14.8	1,39	355	2,300	Sp	[illegible]	Sp	G	Fab	Se	ST	W	Fab	Se	30x33			4
Command-Aire 3-C-3-C	7.2	14.2	1,402	34	2,300	Sp	[illegible]	Sp	G	Fab	Se	ST	W	Fab	Se				6
Command-Aire 5-C-3-A	7.0	19.3	1,284	31	2,030	Sp	[illegible]	Sp	G	Fab	Se	ST	W	Fab	Se				6
Consolidated Commodore	1[illegible]	15.5	10,649	4,340	17,600	D	Bx	D	[illegible]	Fab	Rv	D	Rv	D	Rv				60
Consolidated Model 12	7.0	18.8	1,[illegible]		2,000	[illegible]	[illegible]	[illegible]	[illegible]	Fab	Se	ST	W	Fab	Se	8.5'x18'4"		5'	21
Consolidated Model 32	11.8	8.3	3,553	1,411	5,000	Sp	Box	Sp	G	Fab	Se	ST	W	Fab	Se	62"x80"		54	60
Curtiss-Wright Kingbird	9.5	28.0	1,350		2,100	Sp	Box	Sp	G	Fab	G	ST	W	Fab	Se	36"			
Crown Gunnerbilt B-3	7.6	17.38	1,242		1,750	Sp		Sp	Ply	Cv	Fab	Ply	Wa	Fab-Ply	Ms	24x50"			
Cunningham-Hall PT-6	11.7	13.5	2,670	920	4,350	Sp	Bo	Sp	D	Rv	Fab	ST	Wl	Fab Cg	Se Rv	42x44"	44"x74"	60	27.0
Curtiss-Wright Corp.																			
Curtiss Carrier Pigeon	15.82	11.96	4,255		7,600	ST	W	[illegible]	[illegible]	[illegible]	[illegible]	Mc	Ma	Rv					
Curtiss Hedgehog C6						Sp	Lmd	Ply	G			ST	Wl	Fab	Se				
Curtiss Fledgling K-2						Sp	Lmd	Ply	G			ST	Wl	Fab	Se				
Curtiss Condor	11.5	14.47	11,352	3,600	17,378	D	Rv	D	Rv	Fab	Rv	ST	Wl	Fab	Rv				
Curtiss Robin OX-5	9.09	24.7	1,480	528	2,325	Sp	D	Ad	Rv	Fab	Se	ST	Wl	Fab	Se		32"x47	41"	12.5
Curtiss Robin C-1	9.1	24.05	1,658	454	2,600	Sp	D	Ad	Rv	Fab	Se	ST	Wl	Fab	Se		32"x47	41"	12.5
Curtiss Robin J-1	9.3	13.5	1,625	398	2,600	Sp	D	Ad	Rv	Fab	Se	ST	Wl	Fab	Se		52"x47"	41"	12.5
Curtiss Thrush	12.4	15.8	2,260		3,800	Sp	G	Ad	Sd	Fab	Se	DT	Rv	Fab	Se		38"x81"	43½"	
Keystone Air Yacht	11.1	11.28	5,095	1,150	6,250	Sp	G			Fab		D	Rv				10'x44"		
Keystone Commuter	9.49	15.7	2,088	640	3,300	Sp	G			Fab		D					9'4"x44"		
Keystone Pathfinder	16.3	14.90	10,400	3,462	16,000	Sp	G			Fab							20'x6'6"		
Gipsy Moth 60 G-M	6.7	16.3	1,045	205	1,550	Sp	G	Ad	Sd	Fab	Se	ST	Wl	Fab	Se				
Travel Air A-6000-A	13.4	21.5	3,025	900	4,230	Sp	Box	Sp	Trs	Fab	Se	ST	Wl	Fab	Se	19x21"	96"x38"	48	27.0
Travel Air 6000-B	13.4	21.7	2,067	900	4,230	Sp	Box	Sp	Trs	Fab	Se	ST	Wl	Fab	Se	45x30"	96"x38"	48	27.0
Travel Air A-4000	9.55	16.4	1,869	350	2,650	Sp	Box	Sp	Trs	Fab	Se	ST	Wl	Fab	Se	45x36"			9.0
Travel Air 4-D	10.0	12.8	1,837	420	2,800	Sp	Box	Sp	Trs	Fab	Se	ST	Wl	Fab	Se	38x50"	90"x30		9.0
Davis D-1	9.1	19.0	860	197	1,401	Sp	Bo	Sp	Sd	Fab	Se	ST	Wl	Fab	Se				
Davis D-1 K	10.1	14.6	923	197	1,461	Sp	Bo	Sp	Sd	Fab	Se	ST	Wl	Fab	Se				
Davis D-1 66	10.0	16.8	854	217	1,300	Sp	Lmd	D	Rv	Fab	Se	ST	Wl	Fab	Se				
Detroit Aircraft Corp.																			
Eastman Flying Yacht	11.6	16.0	1,745	575	2,725	Sp	Box	Sp	Wa	Fab	Se	W	[illegible]	[illegible]	[illegible]				
Lockheed Air Express	15.2	10.0	2,533	1,012	4,375	Sp	Box	Sp	W	Ply	G	W	Mo	Ply	G				
Lockheed Vega, Model 5-B	15.4	10.0	2,490	1,448	4,265	Sp	Box	Sp	W	Ply	G	W	Mo	Ply	G				
Lockheed Sirius	12.55	10.2	2,974	456	4,600	W													
Parks P-1	7.4	25.08	1,511	375	2,07[illegible]	Sp	Bo	Sp Ply	G	Fab	Se	ST	Wl	Fab	Ta				
Ryan B-3	14.3	15.5	2,251	920	4,000	W	D	W	G	Fab	Se	ST	W	Fab	Ta	51x53	114"x47"	47	1.3
Ryan B-7	15.3	10.2	2,505	930	4,300	W	D	W	G	Fab	Se	ST	W	Fab	Ta		114"x47"	47"	20
Doyle O-2	8.0	20.5	796		1,350	W	[illegible]	W	G	Fab	Se	ST	W	Fab	Se				
Driggs Skylark	7.6	14.4	976	381	1,579	Sp	Sol	Sp	G	Fab	Se	ST	Wl	Fab	Se				
Fairchild 41	14.8	14.33	2,220		4,300	Sp	Box	W	G	Fab	Se	ST	W	Fab	Se		53"x66"	48	35
Fairchild 71A	16.36	13.75	3,150		5,000	Sp	Box	W	G	Fab	Se	ST	W	Fab	Se		7'x3	54	145
Fairchild KR 34 A	8.4	14.5	1,524	580	2,304	Sp	Box	W	G	Fab	Se	ST	Wl	Fab	Se				
Fairchild KR 21	8.02	17.07	1,012	212	1,550	Sp	Bo	W	G	Fab	Se	ST	Wl	Fab	Se				1.3
Fleet Model 1	8.1	14.32	1,015	211	1,502	Sp	Lmd	D	Rv	Fab	Se	ST	Wl	Fab	Se				
Fleet Model II	8.05	15.78	1,083	210	1,735	Sp	Lmd	D	Rv	Fab	Se	ST	Wl	Fab	Se				
Fleet Model 7	8.0	14.5	1,025	230	1,500	Sp	Lmd	D	Rv	Fab	Se	ST	Wl	Fab	Se				
Fokker AF-10	15.5	10.8	8,950	2,500	13,600	Sp	Box	Ply	G	Ply	G	ST	Wl	Fab	Se	38x50"	19'x60"	69"	105
Fokker Universal	11.2	14.35	2,432		4,000	Sp	Box	Ply	G	Ply	G	ST	Wl	Fab	Se	30x24"	93"x42"	54	30
Fokker AF-11 A	15.3	10.6	4,057	1,380	7,050	Sp	Box	Ply	G	Ply	G	ST	Wl	Fab	Se	36x50"	153"x39"	60	58
Fokker AF-14	15.1	15.7	2,245	1,752	7,200	Sp	Box	Ply	G	Ply	G	ST	Wl	Fab	Se	50x44"	114"x50	60	75.0

See page 124 for key

SPECIFICATIONS OF AMERICAN COMMERCIAL AIRPLANES

Including only planes with Approved Type Certificates—AVIATION does not assume responsibility for the figures given

Manufacturer	Wing Loading (Lb. per Sq. Ft.)	Power Loading (Lb. per H.P.)	Weight Empty with Water in Water Cooled Engine (Lb.)	Pay Load (Lb.)	Gross Weight (Lb.)	Spars: Material	Spars: How Fabricated—Section	Ribs: Material	Ribs: How Fabricated	Wing Covering: Material	Wing Covering: How Attached	Framework: Material	Framework: How Fabricated	Fuselage Covering: Material	Fuselage Covering: How Attached	Cockpit Dimensions	Cabin Dimensions	Minimum Headroom	Vol. Baggage Comp. (cu. ft.)
Fokker AF-32	14.5	10.6	14,910		22,550	Sp	Box	Ply	G	Ply	G	ST	Wl	Fab	Se		550x100	78	85
Fokker Super Universal	14.50	15.2	3,250	1,320	5,550	Sp	Box	Ply	G	Ply	G	ST	Wl	Fab	Se	30x60"	108"x42"	56	50.0
Ford 4-AT-E	13.96	11.25	6,500	1,275	10,130	D	Bx	D	Rv	Ad	Rv	D	Rv	Ad	Rv	30x50"	4'9"x16'2"	5'7"	50
Ford 5-AT-C	16.2	10.7	7,500	1,736	13,500	D	Bx	D	Rv	Ad	Rv	D	Rv	Ad	Rv	42x44	4'9"x19'2"	5'7"	50
Ford 7-AT	15.5	12.6	7,290	1,409	12,350	D	Bx	D	Rv	Ad	Rv	D	Rv	Ad	Rv	42x44	4'9"x19'2"	5'7"	50
Ford 5-AT-C-H	16.2	10.7	8,506	2,536	15,000	D	Bx	D	Rv	Ad	Rv	D	Rv	Ad	Rv	47x44	4'9"x19'2"	5'7"	50
General Aristocrat	10.84	19.70	1,572	548	2,180	Sp	Sol	Sp	G	Fab	Se	ST	Wl	Fab	Se		2'11"x8'0"	4'4"	7.5
General Aristocrat 102-E	12.07	17.0	1,524		2,500	Sp	Lmd	Sp	Ply	Trs	Fab	ST	Wl	Fab	Se		3'3"x7'11"	4'4"	7.0
Gerrond Cabin 111-C	8.64	15.95	1,206		1,745	Sp	Box	Sp	Ply	Trs	Fab	ST	Wl	Fab	Se	34"x34"			
Great Lakes 2T-1A	8.45	17.50	1,062	237	1,580	Sp		Sp		Sd	Fab	ST	Wl	Fab	Se	25'			
Inland S-300	8.07	19.0	765	193	1,290	Sp	Bx	W		D	Fab	Ta	ST	Wl	Fab	Se			
Inland W-500	11.4	10.4	2,900	600	4,500	Sp	Bx	W		D	Sd	Fab	Se	ST	Wl	Fab	5'x40	4'	
Ireland N-2-B	13.0	11.3	5,340	900	4,900	Sp	Bx	W		D	Sd	Fab	Rv	ST	Wl	Fab	80"x40"	4'	
Laird LC-R-300	13.3	10.3	1,922	340	3,010	W	Sol	Sp	Ply	G	Fab	Se	DT	Rv	Fab	Se			
Laird LC-RJ-200	13.6	13.2	1,646	380	2,810	W	Sol	Sp	Ply	G	Fab	Se	DT	Rv	Fab	Se			
Lincoln PT-W	6.6	21.9	1,426	190	1,960	W					Fab	Se	ST	Wl	Fab	Se	24x42"		
Lincoln PT-K	6.8	19.6	1,175	220	1,728	W					Fab	Se	ST	Wl	Fab	Se	24x42"		
Lincoln PT W	6.6	16.4	1,205	220	1,750	W					Fab	Se	ST	Wl	Fab	Se	24x42"		
Mercury Chic	7.4	16.88	935	200	1,550	W		W		ST	Wl	Fab	Se	ST	Wl	Fab	Se	25x42"	
Metal G-2-W	15.8	15.81	1,360	340	5,900	D	Rv	D	Rv	Ad	Rv	D	Rv	Ad	Rv				
Mohawk Pinto	12.00	16.4	1,135	250	1,600	W	G. Box	Ply	G	Fab	Se	ST	Wl	Fab	Se		30x42"		9.3
Mohawk M-1-C	12.00	16.4	1,155	250	1,600	W	G. Box	Ply	G	Fab	Se	ST	Wl	Fab	Se		30x42"		9.3
Mono Monocoupe	9.0	13.41	785		1,280	W					Fab	Se	ST	Wl	Fab	Se			
Mono Monosport	12.5	13.4	1,075	407	1,950	W					Fab	Se	ST	Wl	Fab	Se			
Mono Monocoach	13.05	13.0	1,580	750	2,775	W					Fab	Se	ST	Wl	Fab	Se			
New Standard D-29-A	7.2	17.9	1,190	400	2,740	Sp	Lmd	Ply	G	Fab	Se	D	Rv	Fab	Se				
New Standard D-25-1	7.55	14.0	2,033		3,500	W	Lmd	Sp	G	Fab	Se	ST	Rv	Fab	Se		35x25"		2.5
Nicholas-Beazley Barling NB-3	8.6	21.12	744		1,575	D	Rv	D	Rv	Fab	Se	ST	Wl	Fab	Se		31x22"		4
Nicholas-Beazley Barling NB-3G	8.78	25.42	772	340	1,450	D	Rv	D	Rv	Fab	Se	ST	Wl	Fab	Se				
Nicholas-Beazley Barling NB-3G	8.33	12.05	739	340	1,536	D	Rv	D	Rv	Fab	Se	ST	Wl	Fab	Se				
Ogden Osprey	14.4	16.7	2,050	900	4,500	Sp	Box	Sp	Tru	Fab	Se	ST	Tru	Fab	Se		133"x44"	55"	12
Parkhurst Cabinaire 165	8.5	13.94	1,626	510	2,000	Sp	Lmd	W	G	Fab	Se	ST	Wl	Fab	Se				3
Pheasant H 10	8.0	17.25	1,292	601	2,032	Sp	G	Sp	G	Fab	Se	ST	Wl	Fab	Se				42
Pitcairn PA-7			1,821	636	3,050	Sp	Bo	Sp	G	Fab	Se	ST	Wl	Fab	Se				
Reaevis 2000-C			1,495	355	2,500	Sp		Sp		Fab	Se	ST	Wl	Fab	Se				
Reaevis 3000-C			1,447	370	2,350	Sp		Sp		Fab	Se	ST	Wl	Fab	Se				
Simplex Red Arrow K-2-S	11.8	19.0	1,352	170	1,779	W	Box	W		Fab	Se	ST	Wl	Fab	Se				
Simplex Red Arrow W-2-S	9.0	16.0	1,150	170	1,779	W	Box	W		Fab	Se	ST	Wl	Fab	Se				
Spartan C-3-225	9.0	13.05	1,650	340	2,616	Sp	Sol	Sp	Ply G	Fab	Se	ST	Wl	Fab	Se		30x32"		6.8
Spartan C-3-165	9.29	12.0	1,240	380	2,700	Sp	Sol	Sp	Ply G	Fab	Se	ST	Wl	Fab	Se		30x32"		6.8
Spartan C-3-166	8.61	13.18	1,632	320	2,605	Sp	Sol	Sp	Ply G	Fab	Se	ST	Wl	Fab	Se		30x32"		
Spartan C-4-225	11.75	13.62	2,525	385	4,250	Sp	Sol	Sp	Ply G	Fab	Se	ST	Wl	Fab	Se		40"x84"	51"	9.65
Star Cavalier G	9.0	21.5	855	200	1,405	Sp	Bo	Sp	G	Fab	Se	ST	Wl	Fab	Se				
Star Cavalier	9.02	15.85	919	185	1,425	Sp	Sol	Sp	G	Fab	Se	ST	Wl	Fab	Se				
Stinson SM 6B	17.1	11.7	5,496		8,550	Sp	Ro	Sp	G	Fab	Se	ST	Wl	Fab	Se		40"x92"	49"	
Stinson SM-1 F	13.7	14.4	2,065	539	3,990	Sp	Ro	Sp	G	Fab	Se	ST	Wl	Fab	Se		40"x54"	49"	7
Stinson Detroiter	15.0	14.3	2,614	915	4,500	Sp	Ro	Sp	G	Fab	Se	ST	Wl	Fab	Se		84"x46"	49"	46
Stinson SM-8 A Jr	13.7	24.2	2,060	360	3,150	Sp	Ro	Sp	G	Fab	Se	ST	Wl	Fab	Se		40"x54"	49"	7
Stinson SM-2 A	14.9	11.7	2,234		3,400	Sp	Ro	Sp	G	Fab	Se	ST	Wl	Fab	Se		40"x54"	49"	7
Stinson SM-7	15.7	13.7	2,512		3,100	Sp	Ro	Sp	G	Fab	Se	ST	Wl	Fab	Se		40"x54"	49"	7
Stinson SM 8-B	13.7	14.2	2,175		3,200	Sp	Ro	Sp	G	Fab	Se	ST	Wl	Fab	Se		40"x54"	48"	4.0
St Louis Cardinal C-2-110	9.5	17.7	1,002	366	1,500	Sp	Ro	Sp	G	Fab	Se	ST	Wl	Fab	Se		35"x44"	39"	4.0
St Louis Cardinal C-2-90	9.5	17.7	996	573	1,578	Sp	Ro	Sp	G	Fab	Se	ST	Wl	Fab	Se		35"x44"	39"	
St Louis Cardinal C-2-65	9.5	25.8	912	238	1,610	Sp	Ro	Sp	G	Fab	Se	ST	Wl	Fab	Se				
Swallow TP	6.2	20.25	1,280	180	1,832	W	G	W	G	Fab	Se	ST	Wl	Fab	Se				
Swallow F 28-Ax	8.2	13.06	1,324	340	2,162	W	G	W	G	Fab	Se	ST	Wl	Fab	Se				
Swallow TP-K	3.75	19.6	1,170	170	1,700	W	G	W	G	Fab	Se	ST	Wl	Fab	Se				
Swallow TP W	3.8	15.5	1,201	170	1,755	W	G	W	G	Fab	Se	ST	Wl	Fab	Se				
Texas Temple	10.0	11.25	1,550	567	2,750	W	Bo	W	G	Fab	Se	ST	Wl	Fab	Se				
United Aircraft & Transport Corp.																			
Boeing 100	11.8	3.97	1,882	60	2,750	Sp	Box	Sp	Web	Fab	Se	D	Wl	Rv	D	Rv	Fab	Se	34x45"
Boeing 204	10.62	12.2	3,358	915	3,000	Sp	Box	Sp	Web	Fab	Se	Sp	G. Bo						
Boeing 40-B-4	16.15	11.37	3,950	1,171	6,000	Sp	Box	Sp	Web	Fab	Se	D	D	Fab	Se		52x42"	50"	13
Boeing 80-A	14.8	11.6	10,412	4,057	17,500	D	Bx	Rv	D	Ra	Rv	Fab	Bo	Se			38"x48"	43"	25
Hamilton H 45	14.73	13.10	3,637		5,750	D	Rv	T			Ad	Rv	D	Rv	Ad	Rv	64x60"	5'	
Hamilton H 47	14.73	10.10	3,649		5,750	D	Rv	T			Ad	Rv	D	Rv	Ad	Rv	66x60"	4'8"x5'9"	5'
Sikorsky S-38	13.4	12.5	6,500	2,900	10,480	D	Rv	D	Rv	Fab	Se	D	Rv	Ad	Rv	46x46"	48"x96"	34"	34.5
Stearman LT-1	12.7	11.90	5,890	1,215	6,210	Sp	Box	Sp	Trs	Fab	Se	ST	Wl	Fab	Se	42x32"	38"x88"	12"	40
Stearman C-3-R	12.56	12.2	1,741	400	2,756	Sp	Box I	Sp	Trs	Fab	Se	ST	Wl	Fab	Se	30x40"			10
Stearman 4-E	12.82	9.52	2,026	629	3,750	Sp	Box	Sp	Trs	Fab	Se	ST	Wl	Fab	Se	30x40"			5
Stearman 4-C	13.38	12.67	2,256	653	3,800	Sp	Box	Sp	Trs	Fab	Se	ST	Wl	Fab	Se	40x50"			3
Stearman 4-D	12.34	12.67	2,297	622	3,800	Sp	Box	Sp	Trs	Fab	Se	ST	Wl	Fab	Se	30x40"			5
Verville Sport Trainer	9.27	13.8	1,362		2,040	Sp	Sol	Sp	G	Fab	Se	ST	Wl	Fab	Se	30x22"			
Verville 104-C	12.8	13.1	2,100		3,400	Sp	Sol	Sp	G	Fab	Se	ST	Wl	Fab	Se		92x41"		
Viking Kittyhawk B-2	8.15	18.1	1,139	352	1,850	Sp	Bx	W	G	Fab	Se	ST	Wl	Fab	Se				
Viking Kittyhawk B-4	8.05	18.1	1,402	362	1,829	Sp	Bx	W	G	Fab	Se	ST	Wl	Fab	Se				
Waco 10	7.05	22.3	1,199		2,025	W	Sol	W	Trs	Fab	Ta	ST	Wl	Fab	Ta				
Waco 10	8.05	17.5	1,205		2,050	W	Sol	W	Trs	Fab	Ta	ST	Wl	Fab	Ta				
Waco 225 str	8.03	15.5	1,628		2,600	W	Sol	W	Trs	Fab	Ta	ST	Wl	Fab	Ta				
Waco 225 cab	8.7	14.0	1,671		2,650	W	Sol	W	Trs	Fab	Ta	ST	Wl	Fab	Ta				
Waco, Model F W	8.1	15.0	1,162		1,900	W	Sol	R W	Trs	Fab	Ta	ST	Wl	Fab	Ta				
Waco, Model F K	8.1	11.2	1,095		1,900	W	Sol	R W	Trs	Fab	Ta	ST	Wl	Fab	Ta				
Warrior Argo	7.45	14.04	1,077	200	1,615	W	Sol	W		Fab	Se	ST	Wl	Fab	Se				

See page 124 for key

SPECIFICATIONS OF AMERICAN COMMERCIAL AIRPLANES

Including only planes with Approved Type Certificates—AVIATION does not assume responsibility for the figures given

Manufacturer	Landing Gear: Material	Landing Gear: Type
Aeromarine, 25-A	Ht, ST	Spl
Aeromarine, 26-A	Ht, ST	Spl
Aeromarine, 26-B	Ht, ST	Spl
Alexander Eaglerock A-2	ST	Spl Al
Alexander Eaglerock A 12	ST	Spl Al
Alexander Eaglerock A 15	ST	Spl Al
Alexander Eaglerock A-17	ST	Spl
Alexander Eaglerock, Bullet	ST	Can
Alexander Eaglerock, A-1	ST	Spl
American Aeronautical S-56	ST, D	
American Eagle 730	ST	Spl Al
American Eagle Phaeton 251	ST	Spl Al
American Eagle 201	ST	Spl Al
American Eagle D-430	T	
American Eagle C-430	T	
Arrow A2-60L	ST	Spl Al
Bach 3-CT 8	S	Spl Al
Bach 3-CT 9	S	Spl Al
Bellanca Pacemaker	ST	Spl Al
Bellanca CH-300 Seaplane		
Bellanca Freighter	ST	Spl Al
Bellanca, Pacemaker	ST	Spl
Bellanca, Skyrocket	ST	Spl
Brunner-Winkle Bird Model A	ST	
Brunner-Winkle Bird Model B	ST	
Buhl CA 8-A	S	Spl Al
Buhl CA 8-B	S	Spl Al
Buhl CA 6	S	Spl Al
Buhl CA-3-D	S	Spl Al
Cessna DC-6-A	ST	Spl Al
Cessna DC-6-B	ST	Spl Al
Command-Aire 3-C-3A	ST	Spl Al
Command-Aire 5-C-3Ch	ST	Spl Al
Command-Aire 5-C-3AX	ST	Spl Al
Command-Aire 5-C-3-C	ST	[illegible]
Command-Aire 3-C-3-A	ST	[illegible]
Consolidated Commodore		[illegible]
Consolidated, Model 17	S	[illegible]
Consolidated, Model 20	S	[illegible]
Courier PB-1	ST	[illegible]
Crowe Custombilt B3	ST	[illegible]
Cunningham-Hall PT 6	ST	[illegible]
Curtiss-Wright Corp.		
Curtiss Carrier Pigeon	ST	[illegible]
Curtiss Fledgling Ch	ST	[illegible]
Curtiss Fledgling K2	ST	[illegible]
Curtiss Condor	ST	[illegible]
Curtiss Robin OX 5	ST	[illegible]
Curtiss Robin C-1	ST	[illegible]
Curtiss Robin J 1	ST	[illegible]
Curtiss Thrush J	ST	[illegible]
Keystone Air Yacht		[illegible]
Keystone Commuter		[illegible]
Keystone Patrician	ST	[illegible]
Gipsy Moth 60-GM	ST	[illegible]
Travel Air A-6000-A	Ht S	[illegible]
Travel Air 6000-B	Ht S	[illegible]
Travel Air E-4000	Ht S	[illegible]
Travel Air 4-D	Ht S	[illegible]
Davis D-1	ST	[illegible]
Davis D1-K	ST	[illegible]
Davis D 1-66	ST	[illegible]
Detroit Aircraft Corp		
Eastman Flying Yacht		[illegible]
Lockheed Air Express	ST	[illegible]
Lockheed Vega Model 5B	ST	[illegible]
Lockheed Sirius		[illegible]
Parks P-1	ST	[illegible]
Ryan B-5	ST	[illegible]
Ryan B-7	ST	[illegible]
Doyle O-2	ST	[illegible]
Driggs Skylark	ST	[illegible]
Fairchild 42	ST	[illegible]
Fairchild 71 A	ST	[illegible]
Fairchild KR 34A	ST	[illegible]
Fairchild KR 21	ST	[illegible]
Fleet Model I	ST	[illegible]
Fleet Model II	D	[illegible]
Fleet Model II	ST	[illegible]
Fokker AF-10A	S	[illegible]
Fokker Universal	S	[illegible]
Fokker AF-11A	S	[illegible]
Fokker AF 14	S	[illegible]

See page 124 for key

SPECIFICATIONS OF AMERICAN COMMERCIAL AIRPLANES

Including only planes with Approved Type Certificates—AVIATION does not assume responsibility for the figures given

Manufacturer	Landing Gear: Material	Landing Gear: Type
Fokker AF 32	S	Tred
Fokker Super Universal	S	Tred
Ford 4-AT-E	ST	Tred
Ford 5-AT-C	ST	Tred
Ford 7-AT	ST	Tred
Ford 5-AT-C-S	ST	
General Aristocrat	D	Spl Al
General Aristocrat, 102-E	D	Can
General Cadet 111-C	D	Can
Great Lakes 2T-1A	S	Spl Al
Inland S-300	Wl ST	Spl Al
Ireland N-2-B	ST	Spl Al
Ireland N 2-C	ST	Spl Al
Laird LC-R-300	S	Spl Al
Laird LC-3R-200	S	Spl
Lincoln PT	S	Spl Al
Lincoln PT-K	S	Spl Al
Lincoln PT-W	S	Spl Al
Mercury Chic	ST	Spl Al
Metal G-2 W		
Mohawk Pinto	Ht S	Spl Al
Mohawk M 1-C	Ht S	Spl Al
Mono Monoprep	Ht S	Spl Al
Mono Monoport	Ht S	Spl Al
Mono Monocoach	Ht S	Spl Al
New Standard D-29-A	ST	Spl Al
New Standard D-25-A	ST	Spl Al
Nicholas-Beazley Barling NB-5	ST	Spl Al
Nicholas-Beazley Barling NB-3I	ST	Spl Al
Nicholas-Beazley Barling NB-3G	ST	Spl Al
Ogden Osprey	ST	Spl
Paramount Cabinaire 107	ST	Spl Al
Pheasant H-10	ST	Spl Al
Pitcairn PA 7	S	Spl Al
Rearwin 2000-Co		
Rearwin 2000-C		
Simplex Red Arrow K 2-S	ST	Spl Al
Simplex Red Arrow W-2-S	ST	Spl Al
Spartan C-3-165	ST	Spl Al
Spartan C-3-225	ST	Spl Al
Spartan C-3-100	ST	Spl Al
Spartan C-4-225	ST	Spl Al
Star Cavalier C	ST	Spl Al
Star Cavalier	T	Ol
Stinson SM-6B	ST	Spl Al
Stinson SM-8B	ST	Spl Al
Stinson Detroiter	ST	Spl Al
Stinson SM 8A Jr	ST	Spl Al
Stinson SM-7A	ST	Spl Al
Stinson SM-7B	ST	Spl
Stinson SM-8B	ST	Spl
St Louis Cardinal C-2-110	S	Spl Al
St Louis Cardinal C-2-60	S	Spl Al
St Louis Cardinal C-2-65	S	Spl Al
Swallow TP	S	Str Al
Swallow F 28-Ax	S	Spl Al
Swallow TP-K	S	Str Al
Swallow TP-W	S	Str Al
Texas Temple	S	Spl Al
United Aircraft & Transport Corp.		
Boeing 100	S D	Str Al
Boeing 204		
Boeing 40-B-4	ST	Str Al
Boeing 80-A	ST	Tred
Hamilton H-45	Hts	Spl Al
Hamilton H 47	HtS	Spl Al
Sikorsky S-38	ST	
Stearman 4 T-1	ST	Spl Al
Stearman C-3-R	ST	Spl Al
Stearman 4-E	ST	Spl Al
Stearman 4-C	ST	Spl
Stearman 4-D	ST	Spl Al
Verville Sport Trainer	ST	Spl Al
Verville 104-9	ST	Spl Al
Viking Kittyhawk B-2	ST	Spl Al
Viking Kittyhawk B-4	ST	Spl Al
Waco 90	ST	Spl Al
Waco 187	ST	Spl Al
Waco 223 str w	ST	Spl Al
Waco 275 tap w	ST	Spl Al
Waco Model F W	ST	
Waco Model F-K	ST	
Warner Argo	S	Spl Al

(a) Bulletin 1V Dept of Com Aero Bulletin No 7-A

See page 124 for key

SPECIFICATIONS OF AIRPLANES NOT HAVING GROUP I TYPE CERTIFICATES

AVIATION does not assume responsibility for the figures given

Manufacturer	Designation	Price at Factory	Type	Number Seats	Power Plant	Total Hp.	Span (Ft.)	Wing Area (Sq. Ft.)	Length Overall (Ft.)	Height Overall (Ft.)	Weight Empty (Lb.)	Pay Load (Lb.)	Gross Weight (Lb.)	Normal Range (Miles)	Wing Const.	Fuselage Const.	High Speed (M P H)	Service Ceiling (Ft.)	Type of Control	Brakes	Type of Shock Absorber	Type Certificate Status
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

CANADIAN

Christening a Fokker F-32. Members of the George White "Flying High" cast are seen on top of the plane while Tony Fokker himself is sitting on the nose

And now— the PACKARD-DIESEL *flies the mail*

OVER the post roads of the air, the Packard-Diesel now flies the mail—swiftly, safely and with utmost dependability. For the Thompson Aeronautical Corporation—holder of government mail contracts—has equipped a Stinson plane with a Packard-Diesel and placed it in active service.

T. A. C. was quick to recognize the important advantages of the Packard-Diesel—lower fuel costs, greater fuel economy with resultant bigger pay loads, absolute fire safety and freedom from radio interference. These features meant more profitable, more successful operation.

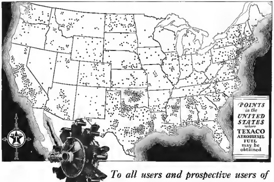
Tests conducted after the Packard-Diesel installation was completed were highly satisfactory and the ship was granted an approved type certificate. Officials plan to use the Packard-Diesel-equipped plane on various T. A. C. routes in order to give all the pilots an opportunity to fly it.

The Packard-Diesel is steadily fulfilling its promise to aviation—"to give new impetus to flight." Today, more and more manufacturers and operators are equipping their planes with this revolutionary powerplant.

ASK THE MAN WHO OWNS ONE

PACKARD

Announcing national distribution for TEXACO AERODIESEL FUEL



To all users and prospective users of the Packard Aircraft Diesel Engine

The Texas Company has arranged a coast-to-coast distribution of TEXACO AERODIESEL FUEL. This highly effective fuel for the Packard Aircraft Diesel Engine is now conveniently available at, or near, all the principal airports of the country. As the use of the aircraft Diesel increases, the distribution of TEXACO AERODIESEL FUEL will be extended to include every flying field in the United States. The unparalleled chain of Texaco wholesale stations in each of our 48 States has made this possible. • Special arrangements for adequate fuel supplies, wherever necessary, will gladly be made for pilots advising The Texas Company in advance of proposed new routes. Write, or 'phone The Texas Company.

THE TEXAS COMPANY, 135 EAST 42nd STREET, NEW YORK CITY

TEXACO AERODIESEL FUEL • TEXACO AIRPLANE OIL
TEXACO AVIATION GASOLINE • TEXACO MARFAK GREASE

The "CITY of CHICAGO" proves Strength and Safety of "SERVICE" AIRCRAFT TUBING

ON July 4th, at Sky Harbor, Chicago, John and Kenneth Hunter gathered the most remarkable record in the history of all aircraft.

Flying their Stinson monoplane, "The City of Chicago," they earned the just tribute of this whole, air-minded nation by remaining aloft for twenty three days—flying a distance more than equivalent to a trip around the world.

Responsible for their success in no small measure, was the structural safety given their craft by "Service" Aircraft Tubing. No other test could possibly have proven the ability of "Service" Tubing to "Get up there and take it" so conclusively as these twenty-three days of constant strain and vibration.

Complete warehouse stocks of "Service" Seamless Steel Aircraft Tubing are available for instant delivery at four convenient cities. Write your nearest branch for monthly stock reports.

SERVICE STEEL COMPANY

1435 FRANKLIN ST DETROIT — 19 SCOTT ST BUFFALO — 32 E FRONT ST CINCINNATI — 216 N ALAMEDA ST LOS ANGELES

A Clearance Sale of 25 Brand New Airplanes Offer Unprecedented Values

The MONOCOUPE 60 . . . Price $2835

NOW PRICED AT **$1895**

A surplus of service parts prompts the immediate clearance of "built up" and "in process" materials of this popular airplane to make factory room for other models.

These airplanes are standard, new and guaranteed in every respect, in fact they are yet to be assembled. (Approved Type Certificate No. 113).

Inasmuch as we must carry service parts at all times, only twenty-five planes of this type will be assembled at this price from service stocks.

Never has such value been offered the flying public. Therefore, it behooves interested parties to make commitments without delay.

Orders will be accepted in turn without favor. A deposit of $500 must accompany orders.

In the sale are several factory reconditioned planes of this type which have been accepted in trade which are offered at prices ranging from one thousand dollars to fifteen hundred dollars.

Monocoupe 60
Specifications and Performance

Two passenger	
Useful load	522 lbs
Span	32 ft
Length	19 ft 9 in
Height	6 ft. 3 in
Fuel Capacity	28 gals
Engine	Velie M5 60 h.p.
High Speed	98 M.P.H.
Cruising Speed	85 M.P.H
Cruising Range	550 miles
Landing Speed	37 M.P.H
Weight—Full Load	1350 lbs.

Bargains in Used Planes With Factory Guarantee

KINNER MONOSPORT	
Less than 10 hours	$2950
J5 MONOCOACH Special upholstering	
50 hours	$4250
J6 MONOCOACH	
Less than 40 hours	$5500
MONOCOUPE 90	
Demonstrator, 50 hours	$2500

Remember this offer is for immediate acceptance only and it may be years before such an opportunity can be duplicated.

MONO AIRCRAFT CORP., Moline, Illinois

SPEED records do not interest the Kittyhawk The record of continued public acceptance is the one to which she aspires. In this respect, her designers have won more than ordinary success The Kittyhawk has achieved an enviable reputation for safety over the land and over the sea She is so dependable, handles so easily, hums along at 90, or will speed to 110 if required Experienced pilots and students alike **rely** on the Kittyhawk which is approved both as a land plane and a sea plane by the Department of Commerce She is the companion plane to the Viking Flying Boat We will tell you a lot about these planes if you wish.

VIKING FLYING BOAT COMPANY
Builders of the Kittyhawk and Viking Planes
New Haven, Conn and Miami, Florida

FIRE—AN INCIDENT OR A DISASTER?

We don't theorize...
we burn real planes to find out!

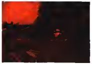
Fire works fast! You must be quick and sure when planes crash; when lives have to be saved and fire controlled. So, instead of theorizing about the best way to put out crash fires, we set real planes on fire at our testing station!

Conditions which would actually be present if a plane crashed were duplicated. We tried out every known extinguishing method. We tried them before an *impartial* jury composed of engineers and experienced operators. We found the best way of putting out these fires—how to get them under control for rescue work in 20 seconds, how to put them out completely.

The results of these tests are available to you. Because this company makes every recognized type of fire fighting equipment—its recommendations can be depended upon as unbiased.

Write for an appointment with one of our fire protection engineers. Or send for the booklet "Sinister Beacons", which describes airport fire hazards and their protection. American-La France and Foamite Corporation, Dept. T65, Elmira, N. Y. *Offices in all principal cities.*

LA FRANCE AND FOAMITE PROTECTION
AN ENGINEERING SERVICE
AGAINST FIRE



GOOD FOR HOURS MORE . . .
This Quaker State Oil thrives on punishment!

Long after ordinary oil would toss in the sponge, Quaker State Aero Oil stands up under the hardest walloping a motor can hand it—stands up and does as perfect a lubricating job as any motor could want.

That's because there's an extra quart in every gallon of Quaker State Aero Oil. A full quart more of heat-battling, friction-soothing lubrication than you'll find in a gallon of ordinary oil.

Ordinary refining leaves in every gallon of oil one quart or more of material that is of little or no value in the lubrication of an airplane motor—a quart of waste.

But Quaker State Aero Oil is not refined in the ordinary way. It is *super*-refined—carried a step further by an exclusive process that removes the quart of waste. In its place you get a quart of the finest lubricant—four full quarts of lubricant to every gallon of Quaker State. So you really get an *extra* quart.

And every gallon of Quaker State Aero Oil is made from 100% pure Pennsylvania Grade Crude Oil—the finest crude oil the world produces.

Get Quaker State Aero Oil at your flying field—and you'll get the finest, toughest lubricant that ever gurgled into a motor. You'll get the longest flying, smoothest, sweetest lubrication the industry knows!

Other Pure Pennsylvania Products are:

QUAKER STATE MEDIUM MOTOR OIL
QUAKER STATE MEDIUM HEAVY MOTOR OIL
QUAKER STATE HEAVY MOTOR OIL
QUAKER STATE COLD TEST
QUAKER STATE TRACTOR OILS

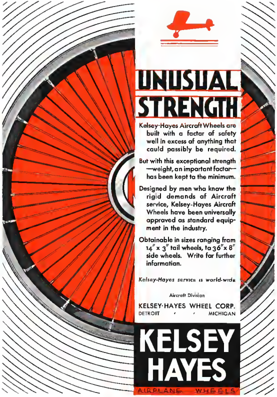
QUAKER STATE OIL REFINING CO., OIL CITY, PA

QUAKER STATE

TRADE MARK REG. U. S. PAT. OFF.

AERO OIL

Get that extra quart in every gallon



UNUSUAL STRENGTH

Kelsey-Hayes Aircraft Wheels are built with a factor of safety well in excess of anything that could possibly be required.

But with this exceptional strength—weight, an important factor—has been kept to the minimum.

Designed by men who know the rigid demands of Aircraft service, Kelsey-Hayes Aircraft Wheels have been universally approved as standard equipment in the industry.

Obtainable in sizes ranging from 14″ x 3″ tail wheels, to 36″ x 8″ side wheels. Write for further information.

Kelsey-Hayes service is world-wide

Aircraft Division

KELSEY-HAYES WHEEL CORP.
DETROIT, MICHIGAN

KELSEY HAYES

AIRPLANE WHEELS

The
SOUTHERN CROSS

●

Five-year old FOKKER tri-motored plane that besting Arctic ice and tropic jungle circumnavigated the globe

THE ROOSEVELT
NEW YORK

2 July, 1930

Dear Tony Fokker,

As the Southern Cross takes off from Roosevelt Field on the great old ship's last long flight, I feel I must express to you once more my lively appreciation of the marvelous flying and lasting qualities of this airplane you built five years ago. They tell me here she could have turned round and flown the Atlantic again within an hour or so after we landed.

I really hate to give her up. But she has well earned honored rest. I hope that she will be placed somewhere to serve as an inspiration to all of us who believe that flying is a thoroughly dependable means of travel. Land plane as she is, she has flown all the world's oceans.

You seem to need no inspiration yourself. When President Hoover was good enough to invite us to the White House we flew down in your latest Fokker, the F-32. And the ship flies beautifully. You have always built planes that flew magnificently. I fought against some of them during the war -- and well I knew them! All of the record flights I have since made were in Fokker planes; so well justified by the safety and durability of the Southern Cross.

Nor can I leave without expressing in behalf of myself and companions our thanks for the generous personal hospitality you have provided for us in New York.

Sincerely yours C Kingsford Smith
(Smithy)

There are smaller Fokker planes than the Southern Cross and larger ones. Fokker will gladly demonstrate any model. Fokker Aircraft Corporation, General Motors Building, New York

Changing Emergency Landings from Crises to Incidents . . .

No part of an aeroplane is built from finer materials or with more care and precision than are Aerol Struts.

THE increased acceptance of flying rests upon better control of the plane while being landed under emergency conditions

Such performance depends upon the plane's minimum flying speed and its landing gear. Manufacturers owe it to their future and to the pilot and the flying public to give their planes maximum landing performance.

That is why an increasingly large group of plane manufacturers have standardized on Aerol Oleo Pneumatic Landing Struts. Their presence under the plane changes the vast majority of emergency landings from crises to incidents and establish unequaled confidence on the part of the pilot.

The telescoping action of these powerful and efficient cylinders absorbs initial impact, eliminates "crow-hopping" and shortens the roll.

Aerol Struts are made in the Military Type of extreme service and the commercial type for ordinary operation. Complete information will gladly be sent on request.

Aerol Struts are manufactured by The Cleveland Pneumatic Tool Company, Cleveland, Ohio.

ASK THE PILOTS WHO LAND ON THEM

AEROL *shock absorbing* STRUT

Flying the east coast of SOUTH AMERICA *with* "NYRBA"

A Fleet of Nine Sikorsky Amphibions contributes comfort, luxury and speed to the service of the world's longest air line

SIKORSKY AMPHIBION

Rio, from your window in the comfortable Sikorsky Amphibion cabin. A picturesque city, three feet above sea level, surrounded by conical mountains and curving bays

Some hundred and forty miles northeast of Rio de Janeiro lies the city of Campos The leisurely Parahyba River provides a waterway for small steamers . . . and an excellent landing field for Sikorsky Amphibions

TO the New York, Rio and Buenos Aires Line goes the distinction of putting wings on the great Eastern trade route to Latin America's six billion dollar markets Their 10,000 mile transport system extending from Miami, Florida, to Santiago, Chile, links together 16 nations and colonies of the Americas Travel time between the United States and Chile is cut to 8 days . . . a saving of 12 days over travel by boat

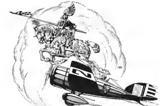
As an important part of its flying equipment "NYRBA" uses a fleet of 9 Sikorsky Amphibions These fast, luxurious ships are used to provide complete point-to-point service over the route With their capacity to land upon and take off from either land or water, these "S-38's" are particularly valuable along the East Coast Powered with two 420 H P "Wasp" engines, the "S-38" can fly and maneuver on either engine She has a cruising speed of 110 miles per hour, which contributes generously to time economy.

Equally valuable to business men at home are the qualities of the "S-38" which influenced the selection of this ship for use on the "NYRBA" lines With many cities having waterways close to their business centers, the "S-38" allows its owner to take full advantage of the great economies of air travel A recently issued folder covers more details of the "S-38" May we send you a copy? Sikorsky Aviation Corporation, Bridgeport, Connecticut Division of United Aircraft & Transport Corporation

Sikorsky S-38 Holder of Four World's Seaplane Records—

3 Altitudes with respective loads of 4400 pounds 2204 pounds and 1100 pounds

1 Speed with 4409 pounds load at 143.7 m.p.h. —carrying this weight faster than ever before On Water—On Land—In Air



Knighthood a'wing!

$100,000.00 IN CASH and many valuable trophies will be distributed. If you have not received your copy of the "Schedule of Events and Prizes," and information on hotel reservations, etc., write for it now. Address, Cliff W. Henderson, General Manager, National Air Races, Hotel Sherman, Chicago.

WITH the dash, daring and genius of a Knighthood that rides the skies, the 1930 National Air Races will unfurl the banner of aeronautical progress.

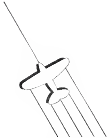
This year, more than ever, the races will be the gathering place for everyone in aviation. There will congregate the old timers and the new students, the executives and employees. There will be the world-famous Knights and Ladies of the Air, and the unsung, but vitally important, "grease monkey." There will be new ships, new motors, new instruments—and there will be made new fame by men and women pilots from all parts of the world.

Come, enter, profit, and enjoy yourself at the most colorful classic of the sky—*and Come-A-Flying!*

NATIONAL AIR RACES

August 23 to September 1, 1930

CURTISS-REYNOLDS AIRPORT—CHICAGO



SPECIFY CONTINENTAL

There are four cardinal points which every engineer considers in specifying aircraft power. They are dependability, economy, convenience and smoothness. These are the vital elements. They are also the outstanding characteristics of Continental Aircraft Engines, for precision building achieves supremacy in each of them. It is therefore only logical that keen buyers of practical aircraft power recognize these obvious advantages implied in the phrase, Precision Built . . . and specify Continental.

"Approved Type Certificate No. 32, U. S. Department of Commerce"

CONTINENTAL AIRCRAFT ENGINE CO.
General Office and Factory Detroit, Michigan

Continental Engines

Drawing upon the facilities and experience of the greatest engine builder in the world, Continental is uniquely enabled to counsel with the trade in the design and production of engines to fit individual requirements.

More air transport miles daily than any other gasoline

HERE is the supreme test of any motor product...the grueling test of day-in-and-day-out transport service! It takes power and speed, perfect carburetion...a gasoline of the very highest quality and uniformity. ¶ It is significant that more miles are flown daily with Richfield in this service than any other gasoline made. The great air lines including . . . Western Air Express, T.A.T.-Maddux, Pan-American Airways, Standard Airlines, Mid-Continent Air Express, West Coast Air Transport . . . rely on Richfield in the maintenance of uninterrupted schedules. ¶ The qualities that make Richfield the choice of the world's great air lines . . . are every bit as essential in your own plane for normal flying . . . or sudden emergencies. Use Richfield . . . and be sure! Ask for it at your airport!

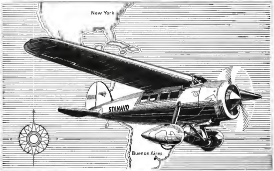
RICHFIELD AVIATION GASOLINE

Available at important airports throughout the United States

RICHFIELD

RICHFIELD OIL COMPANY — LOS ANGELES — NEW YORK CITY

First in Aviation



- - and still the Pioneer

The builders of the world's first airplane tires, 22 years ago, are today winning ever-widening recognition as the pioneers in aviation tires and rubber products.

Recently, they contributed to another world record flight—when Lieutenants White and M. S. Mullen flew Lockheed No. 1, of the Standard Oil of New Jersey fleet, from New York to Buenos Aires in 51 hours, 36 minutes, flying time. Another demonstration of U. S. dependability was written into the record books of aviation. The most substantial progress in the aeronautical world today is being made by those who are employing products and principles proven by a generation of American flying. Among these are safe, sure, practical U. S. Tires—first in aviation, and still the pioneer.

UNITED STATES RUBBER COMPANY—WORLD'S LARGEST PRODUCER OF RUBBER

U. S. ROYAL AIRPLANE TIRES

...on the world's longest air line regularly operated...

"NORMA-HOFFMANN"
PRECISION BEARINGS

The Leece Neville generators used on Boeing mail planes and mail passenger planes, are also equipped with NORMA-HOFFMANN *Precision Bearings*

The Boeing 18-passenger, tri-motored transport planes on the San Francisco-Chicago air line, are powered with three Pratt & Whitney "Hornet" 525 H. P. engines with superchargers running on NORMA-HOFFMANN Precision Bearings.

"Where the bearings must not fail"—where service must not be interrupted—NORMA-HOFFMANN Bearings afford the quality which assures safety against bearing troubles. *Write for the catalogs.*

NORMA-HOFFMANN BEARINGS CORPORATION STAMFORD, CONN., U.S.A.

For every flying hour

ANYWHERE *you go!*

For every flying reason **STEARMAN**

Passenger and mail operators on split-minute schedules, aviating sportsmen on their own . . . relax comfortably in the knowledge that wherever their flying takes them they are always at home with a Stearman. Spotted at points all over the broad land, east to west, north to south, they find Stearman facilities, Stearman equipment, Stearman alertness to serve them—Stearman co-operation. 300 H. P. and 400 H. P. Junior Speedmail, 225 H. P. Business Speedster . . . Write, wire or telephone.

STEARMAN AIRCRAFT COMPANY, WICHITA, KANSAS
Division of United Aircraft and Transport Corporation

A NEW AVIATION OIL

Every engineer and pilot in the industry agrees that a need exists for a better aviation oil. Motor hours are all too few. Overhaulings are entirely too frequent. Too much wear takes place in "cold" motors. Too much chance of failure exists when motors overheat. Now comes a new oil for flying motors, offering a definite answer to these problems. It is an oil built on a principle which has been proven in the motors of more than a million automobiles. It is an oil entirely different and superior to any aero-lubricant heretofore offered.

The coming of this new lubricant will change all previous ideas of the part played by oil in successful aviation operations. It will eliminate much of the shameful waste that now takes place when costly motors are permitted to wear themselves into discard after so few hours of productive use.

It had to come. Someone had to do it. A better oil was vitally necessary to the future of aviation. Ordinary mineral oils were found lacking in sustained ability to prevent friction.

It remained for Conoco to fill this need with the only really new advancement in lubricants since 1901. Conoco engineers foresaw, as far back as Lindbergh's high school days, that the aviation industry would require this improvement over straight mineral oils. Though no time was lost, neither was there any rushing of chemical tests and field investigations.

The little group of chemical engineers who were entrusted with this work spent countless hours on their painstaking task. Working quietly, almost secretly, over a period of years, and backed by every resource of this company, these men slowly developed and tested the new product.

As a result of this work the Germ Process was made available to the industry in the new Aero Germoil. It was known that Germ Processing caused automobile oils to do some revolutionary things. They were found to *penetrate metal surfaces* in the motor, to cling there in heat and cold, in motion or idleness, under all operating conditions, and so to provide constant, *unfailing* lubrication. It was known that test automobiles had frequently traveled scores of miles only on the film provided by the oil in the "pores" of the surface metal, all the free oil having been purposely drained away!

The Germ Process, it should be explained, adds to a selected paraffin base, thoroughly dewaxed oil, an oily essence, giving the lubricant the property of increased oiliness present in fixed oils plus the stability of the mineral oils, without the disadvantages of either. The basic patents for the United States, Mexico and Canada for this revolutionary process are owned by Conoco.

Conoco Aero Germoil will reshape all opinions about oil merit, relieve the anxiety of air-motor operators, lengthen motor life, revise aviation oil buying habits, and will . . we believe . . . receive universal acceptance! Continental Oil Company, Ponca City, Okla.; Albuquerque, N. M., Butte, Mont.; Denver, Colo.; Great Falls, Mont.; Kansas City, Mo.; Lincoln, Neb.; Richmond, Va.; New York, N. Y., Salt Lake City, Utah; Wichita Falls, Texas; (Conoco Oil Company) Chicago, Ill.

CONOCO AERO GERMOIL

"We get $5 a ride . . . take in an average of $75 per hour with our EASTMAN *Flying Yacht*"

"THE Eastman Flying Yacht has opened up for us an entirely new field for taxi and charter work. People ride in this trim seaplane whom we would never be able to attract with a landplane. We can bring it directly to where people with money congregate. Thus we find that we can keep the Eastman busy three to six hours a day on passenger-hopping alone at resorts having less than 4000 population . . . We get $5 a ride and we take in an average of $75 per hour."

This quotation from a letter from Associated Aircraft, Chicago, Ill., offers conclusive proof that the Eastman Flying Yacht is a big money-maker. Operators near lakes or sea-side have an opportunity to cash in on this new passenger-hopping business!

The Eastman powered by a 170 H.P. engine lists at only $9985. Its two spacious cockpits accommodate three passengers and pilot in comfort—a generous payload capacity. Operating costs are low—approximately $15 per hour including overhead and all expenses. A net profit from commercial operation of $1000 per week can be easily made with an Eastman!

Write today for an illustrated catalog and complete information on the Eastman Flying Yacht—learn more about the profit possibilities it offers. Our dealer plan will interest operators who want to secure additional profits from airplane sales.

EASTMAN AIRCRAFT CORPORATION
RYAN AIRCRAFT CORPORATION
LOCKHEED AIRCRAFT CORPORATION
AIRCRAFT PARTS CO., INCORPORATED
PARKS AIR COLLEGE, INCORPORATED
PARKS AIRCRAFT CORPORATION

DETROIT AIRCRAFT

FORT AND CAMPAU STREETS, DETROIT
Chanin Bldg., New York :: Roosevelt Bldg., Los Angeles

BLACKBURN AIRCRAFT CORPORATION
AIRCRAFT DEVELOPMENT CORPORATION
MARINE AIRCRAFT CORPORATION
GROSSE ILE AIRPORT INCORPORATED
GLIDERS, INCORPORATED
DETROIT AIRCRAFT EXPORT CORP

2 WAYS TO SURFACE AN AIRPORT

(1) The WRONG way . . . An almost new airport surfacing rapidly disintegrating under the stress of tailskid lacerations.

(2) The RIGHT way . . . A Gilmore plastic surfaced Airport, unaffected by tailskids, always live and plastic, impervious to water, unaffected by heat or cold.

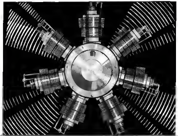
MORE and More . . . airport operators and aerial transport lines are demanding the safety and economy that only a Gilmore Airport surfacing provides.

Twenty five years of successful surfacing with asphaltic oils, qualifies Gilmore to solve your airport surfacing problems. Gilmore Oil Company, 2423 East 28th Street, Los Angeles.

GILMORE
Special Asphaltic
AIRPORT OILS

204A

THE ONE METAL THAT FLIES BEST



Weight saved in the engine . . . puts extra pay-load in the plane

One of Commercial Aviation's greatest problems is how to get more revenue per plane trip. Every pound of excess dead-weight stripped from the engine means an extra pound added to the pay-load.

The development of the light, strong Alloys of Alcoa Aluminum has contributed to the ever-increasing reliability and light-weight of the aircraft engine. No wonder more and more aircraft engine designers are using these Alloys—one engine builder uses 54 parts made of Alcoa Aluminum in his engine.

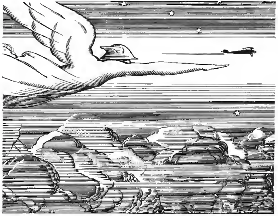
While weighing only 1/3 as much as iron or steel, the light, strong Alloys of Alcoa Aluminum are exceedingly strong. Heat treated, some of these Alloys attain a tensile strength equal to structural steel—55,000 pounds per square inch *minimum*.

Our nearest office will gladly send a competent representative to give you full information on the application of Alcoa Aluminum Alloys to aircraft engines. Address ALUMINUM COMPANY of AMERICA, 2482 Oliver Building, PITTSBURGH, PA.

ALCOA

ALCOA ALUMINUM

ONLY WRIGHT HAS BEATEN WRIGHT AROUND THE WORLD!



OVER both Poles Wright engines drove Admiral Byrd. Across the Pacific and the Atlantic "Whirlwinds" took Kingsford Smith. From New York to Bermuda and back non-stop, Wright powered Roger Williams' plane—the same engine and plane which flew Chamberlin from America to Germany. For a distance equal to twice round the planet, a new stock "Whirlwind 300" flew the Hunter Brothers for over 3 weeks! That's why Wright engines power more planes, fly more miles, hold more records than any other engine—and why still greater deeds by Wright are even now in store!

WRIGHT

AERONAUTICAL CORPORATION
PATERSON, NEW JERSEY
A DIVISION OF CURTISS-WRIGHT CORPORATION

Flying is the big attraction!

...But swimming, golf and tennis also bring thousands to CENTRAL AIRPORT

Central Airport is headquarters for Department of Commerce Second Inspection District. Fire-proof hangars. Latest mechanical equipment. Teletype and radio weather service. Complete lighting for night flying. The field is level, naturally drained, openly approached.

EVER SINCE its opening just one year ago, Central Airport has been the center of aviation activities in this section.

Now, it is also being made a great recreation center. To attract new thousands of potential customers for transport and sight-seeing services. To promote wider patronage for the manufacturers and selling and servicing agencies located here! To provide additional incentive to owners of private planes to make this their headquarters!

The recreational unit is opposite the flying field and separated from it by a 10-lane boulevard. 100,000 motor cars have passed here on a summer's day. Nearly 4000 of them have been parked inside Central Airport *at one time.*

Here is the most accessible metropolitan airport in the world. City Hall, Philadelphia, is but 15 minutes away by car or bus, the center of Camden is within 6 minutes. In the Philadelphia-Camden area are 3,000,000 people, thousands of trained mechanics, and hundreds of factories producing materials essential to the aviation industry.

Get in the "swim." Come to Central Airport. Every modern convenience! Highly desirable land still available to responsible parties *on most attractive terms.* For particulars, write Central Airport, Inc., Camden, New Jersey.

Two swimming pools with sandy beaches. Two miniature golf courses. Two practice golf driving ranges. Tennis courts. Picnic grounds. Airport Grill. Restaurant and rest rooms. Unlimited free parking space.

Five main highways converge here: The White Horse Pike to Atlantic City; Marlton Pike to Lakehurst and Spring Lake; New Jersey State Highway to New York, Kaighn Avenue to center of Camden; Crescent Boulevard to Philadelphia.

RECORDS ...UNHERALDED!

Over sea or over land . . . safely and swiftly to the destination

WITH airplanes flying a total of 83,000 miles daily in the United States, it is not surprising that records frequently go by the board unheralded by newspapers. Several recent performances of Ford commercial planes deserve to be emblazoned on the records as evidence of the efficiency of the tri-motored, all-metal transport . . .

A Ford all-metal, tri-motored Army plane flew 1140 miles over land and sea from Miami to France Field, Panama Canal Zone, in 11 hours and 20 minutes, with a crew of four. In this record flight it passed through two rain squalls and dodged another. The official report said: "Plane and engines functioned perfectly, so the flight was made without particular incident."

The "Firestone," a Ford all-metal, tri-motored transport plane, carrying five passengers and two pilots, flew from Jacksonville, Florida, to Akron, Ohio, 1015 miles, with two stops, in 7 hours and 50 minutes actual flying time, an average within a fraction of 130 miles an hour!

Most notable of all is the record of Stout Air Lines which have completed 1,000,000 miles of safe flight, carrying 107,000 passengers.

THE FORD PLANE

The Ford plane is planned, constructed and operated as a commercial transport. Built of corrugated aluminum alloys, it has great structural strength and durability, and is most economical to maintain in operation. The uniformity of its material is determined by scientific test. All planes have three motors in order to insure reserve power to meet and overcome emergencies. The engines may be Wright, Pratt & Whitney or Packard Diesel, totaling from 675 to 1275 horse-power. Ford planes have a cruising range of from 580 to 650 miles at speeds between 55 and 135 miles per hour. Loads carried from 3630 to 6000 pounds.

The capacity of these planes is 9 to 15 passengers and a crew of two (pilot and assistant). Planes can be equipped with a buffet, toilet, running water, electric lights, adjustable chairs.

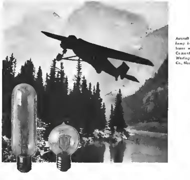
The price of the Ford tri-motored, all-metal plane is exceptionally low—$40,000 to $50,000 at Dearborn.

Ford branches will be glad to give you information on the Ford tri-motored all-metal plane in all models.

FORD MOTOR COMPANY

Visitors are always welcome at the Ford Airport at Detroit

The Ford Plane



Aircraft and airway lamp bulbs set in bases with Bakelite Cement. Made by Westinghouse Lamp Co., Bloomfield, N.J.

AIRCRAFT AND BEACON LAMP BULBS
SET IN BASES WITH BAKELITE CEMENT

In the development of electric lamps for revolving beacons and aircraft headlights, Westinghouse engineers worked to provide a lamp with bulb so securely fastened to the metal base that it would not become loosened when exposed to adverse weather, or from vibration. Experiments demonstrated the exceptional bonding and weather-proof properties of Bakelite Cement, and lamps in which it is used are rated U. S. Standard.

Bakelite cemented lamps are in constant use for headlights on U. S. Air Mail planes. Similar lamps, of greater wattage, are also standard for the rotating beacons operated by the U. S. Department of Commerce on all the lighted airways of the country. In addition, each beacon uses two of these lamps as marker lights. Bakelite Cement provides a lasting band of high mechanical and dielectric strength. Non-hygroscopic and non-deteriorating this cement does not become impaired by moisture or changing atmospheric temperatures. Our Booklet 59 V, "Bakelite Varnish—Baking Type," will be mailed upon request.

Manufacturers are invited to enlist the cooperation of Bakelite Engineering Service.

BAKELITE CORPORATION, 247 Park Avenue, New York. CHICAGO OFFICE, 635 West Twenty-second Street
BAKELITE CORPORATION OF CANADA, LIMITED, 163 Dufferin Street, Toronto, Ontario

BAKELITE

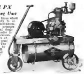
THE MATERIAL OF A THOUSAND USES

Model A

Air cooled and made in sizes from 1½x1½ to 4½x5. Displacements from 1 cu.ft. to 37 cu.ft. depending upon size of compressor and motor used. Furnished also with tight and loose pulleys if desired or with type pulley.

Model PX
Paint Spraying Unit

A compact portable three wheel unit. Complete ready to operate paint spray equipment. Has 35 gal. tank, pressure gauge, safety valve and drain cock, also suction unloader to maintain operating pressure of 80 lbs. which may be adjusted for any suitable pressure up to 100 lbs. The air filter is warranted by maker to be 99.9% efficient. Sizes 2½x2¼ and 3x3½. Displacements 4.2 and 5.8 cu.ft. depending upon size of motor.



Quincy

To Airport Operators and Airplane Manufacturers who are "up" on compressors, "Quincy" stands for "Quality" —a high standard of quality that begins at the very foundation—the design.

Quincy design is of such a character that Quincy operation is noticeably quiet—so quiet that you realize at once that here is perfection.

And that realization is confirmed and re-confirmed throughout the whole long life of the compressor; for high efficiency and low maintenance cost extend far beyond your fondest expectations. That is why the Quincy warrant of absolute satisfaction is unlimited.

For paint and dope spraying, operating pneumatic tools and lifts, for spray cleaning engines, blowing out gas and oil lines inflating tires—get a Quincy for real economy.

Write for complete information, or send the coupon at right.

Model WC

Automatic, water cooled, complete unit with automatic water valve, motor starter and pressure control for heavy duty. 15 to 126 cu.ft. displacements. 2 to 25 HP motor. 150 lb. cut off pressure. Tank 18x72, 24x72, 30x78 varying with size of compressor. Multiple V Belt drive.

QUINCY COMPRESSOR CO.
208 Maine St., Quincy, Ill.
Please send complete information about Quincy Compressors for use as follows

Firm Name
Address
City State

N1660

SERVICE AND SALES

Atlanta, Ga.	Kansas City, Mo.
Birmingham, Ala.	Memphis, Tenn.
Boston, Mass.	Newark, N. J.
Chicago, Ill.	New Orleans, La.
Cincinnati, Ohio	St. Louis, Mo.
Cleveland, Ohio	Waco, Texas
Davenport, Ia.	Washington, D. C.
Detroit, Mich.	

Also in other important centers

QUINCY Compressors

Quincy, Illinois

Fifty two planes of the Aircraft Squadron Battle Fleet being fueled with Socony Aviation Gasoline at Boston Airport.

52 Battle Planes Fueled with Socony in 2½ Hours

SOCONY officials at Boston Airport made another record for themselves when they fueled 52 planes of the Aircraft Squadron Battle Fleet with 1840 gallons of Socony Aviation Gasoline in two and a half hours.

Uncle Sam's fighting planes must have a gasoline that is entirely dependable. Their selection of Socony Aviation Gasoline is in line with the policy of many airports throughout New York and New England where Socony petroleum products are designated the official fuel

SOCONY

AVIATION GASOLINE · AIRCRAFT OIL

STANDARD OIL COMPANY OF NEW YORK

FAMOUS FLIGHTS WITH THOMPSON VALVES

From NEW YORK to GERMANY with the "COLUMBIA"

(This advertisement is one of a series recalling historic airplane flights in which Thompson Valves were used).

For the second time in one year, a brilliant trans-Atlantic flight was successfully completed when the plane "Columbia" landed in Eisbaden, Germany, on June 6th, 1927.

For the second time within a period of two weeks, Thompson Valves had demonstrated their dependability in an undertaking that drew the attention of the entire world.

During the Columbia's 3911-mile flight

the eighteen Thompson Valves of the rugged Wright "Whirlwind" motor operated continuously in a stream of explosive flame. The unusual durability of these specially-processed valves proved more than adequate in this flight, as it has in practically every major American endurance flight since 1925.

Repeated evidence such as this has led to the specification of Thompson Valves for today's finest American aero motors.

THOMPSON PRODUCTS, INCORPORATED
General Offices: Cleveland, Ohio, U. S. A.
Factories: CLEVELAND and DETROIT

Thompson Valves

Haskelite in this Stinson plane helped make possible the world's endurance record for re-fueling flight.

STABILITY

of materials entering into plane construction is as important as stability in plane performance. In Haskelite aviation plywood, stability is assured by the use of blood-albumin glue. This remarkable water-resisting bond has been proved in service by 85% of the plane builders—one of which is the Stinson Aircraft Co. whose endurance record holder—"City of Chicago" is Haskelite equipped.

We will be glad to send you engineering data on Haskelite and Plymetl (metal-faced plywood) and their aircraft applications.

Curtiss Flying Service
California Panel & Veneer Co
Los Angeles, Calif.
Air Associates, Inc
Garden City, L. I.
In Canada, Railway & Power Engineering Corporation, Ltd.

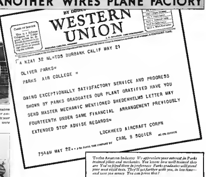
HASKELITE
MANUFACTURING CORPORATION
120 SOUTH LA SALLE STREET, CHICAGO, ILLINOIS

AHG-13

PARKS-trained men make good

"SEND US ANOTHER" WIRES PLANE FACTORY

Back in April the Lockheed Aircraft Corporation wired to Parks: "That your authority offer employment upon arrival Burbank four students your selection." These four Parks-trained men were selected.



WESTERN UNION

A KZA1 32 NL=TDS BURBANK CALIF MAY 21

OLIVER PARKS=
PARKS AIR COLLEGE =

OWING EXCEPTIONALLY SATISFACTORY SERVICE AND PROGRESS SHOWN BY PARKS GRADUATES OUR PLANT GRATIFIED HAVE YOU SEND MASTER MECHANIC MENTIONED SHEDENHELMS LETTER MAY FOURTEENTH UNDER SAME FINANCIAL ARRANGEMENT PREVIOUSLY EXTENDED STOP ADVISE REGARDS=

LOCKHEED AIRCRAFT CORPN
CARL B SQUIER

754AM MAY 22.

One month later in May came the telegram reproduced to the right and another Parks-trained man gets ready to take a good-paying position with one of aviation's leaders.

To the Aviation Industry: We appreciate your interest in Parks trained pilots and mechanics. You know how well trained they are. You've hired them in preference. Parks graduates will stand your most rigid tests. They'll get farther with you, in less time—and save you money. You can prove this!

Every week they leave us—well-trained, confident—eager to take up their good-paying work as pilots and mechanics. Every week they come to us—wondering if Parks is *really* the world's greatest aviation school. And what do they find? A college that even surpasses their imagination, equipped without regard for expense—the pick of the country's skilled instructors—every hour packed with interest, flying, "tinkering," studying—clean, commodious living quarters—ample recreation facilities, good food, good fellows, and a career ahead!

If you have a spark of ambition—and vision enough to see the vast possibilities aviation is opening up—you belong at Parks—*and now is the time!* Every man with us today was "trying to decide" a few short months ago. Every one of them is further ahead than you are. The days are precious. Aviation can't succeed without well-trained men, and Parks-trained men are 'way out in front in ability, skill, and experience. Join today—"tomorrow" never comes. Mail the coupon.

Parks Air College was one of the first to be licensed by the U. S. Department of Commerce as a fully accredited transport school

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DIVISION OF DETROIT AIRCRAFT CORPORATION
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A DEMONSTRATION flight in the Bellanca *Pacemaker* is something more than just another "airplane ride." To even the airwise, it's a revelation of plane-building skill and performance.

In the comfortable, roomy cabin you will observe a quality of coachwork that has contributed notably to the Bellanca reputation—"America's Finest Airplane." The pilot will explain that you are enclosed within an ingeniously-designed body, a frame of protecting steel which provides an unapproachable degree of safety.

As you take the air, you will notice the snappy ease of the take-off, the quick climb, the fluent swiftness of the plane as your speed mounts to 145 miles an hour. Bellanca stability will have a new and impressive meaning to you. Perhaps you will want to take the dual controls—then you'll appreciate their fingerlight responsiveness and the importance of Bellanca flying qualities, that smooth "grip" on the air at all speeds.

It's an experience worth having, for it gives you a higher conception of airplane quality. And a demonstration flight can be arranged promptly to your convenience.

The Bellanca Pacemaker is a six-place cabin monoplane with 300 h.p. engine, Wright or Pratt & Whitney. Finished in finest automobile coachwork. High speed, 145 m.p.h. Payload with pilot 1,235 lbs. U. S. Department of Commerce Approved Type Certificates No. 129 and No. 328. *The Bellanca Skyrocket* of similar specification is powered with the 420 h.p. Wasp engine. High speed 150 m.p.h. U. S. Department of Commerce Approved Type Certificate No. 319. Both types are readily convertible into excellent seaplanes. *The Bellanca Airbus* is a 12 to 14 place single engined monoplane, particulars of which will be sent on request to any commercial operator.

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Manufacturers of the de Havilland "MOTH"

FACTORY AND FIELD

LOWELL MASS.

November 22, 1929

Mr. Thomas S. Colby, Manager,
Aviation Department,
Berry Bros., Inc.,
Detroit, Michigan.

Dear Mr. Colby:

Although we have only been in production since early summer we have finished over 120 Gipsy Moth airplanes with Berry Bros. Inc. products. Most of our departments have had the usual troubles in getting into production but the Dope and Finishing Departments have operated at high efficiency as a result of having standardized on Berry Bros. Inc. material from the start.

Thanks to your very efficient service and your excellent advisory and engineering departments we have been saved a great deal of delay in finishing our ships, and we desire to express our appreciation of your products and of your organization at this time.

Yours very truly,

MOTH AIRCRAFT CORPORATION

Minton M. Warren

MINTON M. WARREN
President

MMW:ERW

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Introducing America's first conventional type airplane to sell for less than $1,000.00 . . the American Eaglet.

This is the airplane which will make America airplane-minded. It will take the altitude out of the high cost of flying. The cost of operation is less than $1.00 an hour.

Rugged, snappy of appearance and possessing marvelous performance characteristics, the American Eaglet is the foremost ship on the market today for sport or student training flying.

It is the first featherweight airplane to be presented with air wheel landing gear equipment. Your landing gear worries never begin with the American Eaglet.

The twenty-five horsepower Cleone engine, a two cylinder, two cycle power plant weighing forty-six pounds, has taken the ship to 8150 feet in 64 minutes.

The American Eaglet lands and takes off virtually in its own length; it has an air speed of approximately 60 miles an hour, and its gliding ratio is 12 to 1.

The American Eaglet in a remarkably short span of time will be the world's fastest selling airplane.

Dealers in aircraft and those interested in selling this plane should wire for our proposition immediately.

ABOUT THE AMERICAN EAGLET
(Cleone Powered)

Takeoff .... 25 to 55 feet
Landing Speed .... 15 m.p.h.
Climb .... 355 ft. per min.
Air Speed .... 55 m.p.h.
Cruising radius .... 175 miles
Gliding ratio .... 15 to 1

Color Scheme:
Chrome Yellow Wings with Green Fuselage.

Fuel Tankage:
Five gallons of fuel, eight parts gas to one of oil carried in a single tank.

Weights:
Gross weight .... 583 pounds
Engine weight .... 45 pounds

Dimensions:
Length over all .... 21 ft. 6 in.
Span .... 34 ft., 4 in.
Height .... 75 inches
Surface area total 154.4 sq. ft.

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It is understood that if I become an American Eagle Distributor or Dealer I may have a sales franchise covering the American Eaglet.

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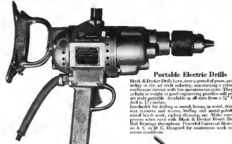
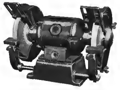


Portable Electric Drills

Black & Decker Drills have, over a period of years, proven their utility in the air craft industry, maintaining a reputation for continuous service with low maintenance costs. They are built as light in weight as good engineering practice will permit, and are truly portable Available in all sizes from a ¼" light duty drill to 1½ inches.

Invaluable for drilling in metal, boring in wood, driving valve seat reamers and stones, buffing and metal polishing, wire wheel brush work, carbon cleaning, etc. Make excellent drill presses when used with Black & Decker Bench Drill Stand Ball Bearings throughout Powerful Universal Motors operate on A C or D C. Designed for continuous work under most severe conditions



Electric Bench Grinders

Pictured is the Black & Decker 10" Electric Bench Grinder. Fill the need for a quality grinder, at low cost for general purpose grinding and tool sharpening Wheel guards are adjustable for grinding at any position on circumference of wheels. Two wheels are furnished—1 coarse and 1 fine A sturdy, versatile, grinder for aircraft work Black & Decker Electric Bench Grinders are made in 6", 7" and 10" sizes Pedestals obtainable for the 7" and 10" Sizes at nominal prices.

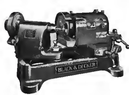
Bench and Post Drill Stands

Black & Decker Drill Stands quickly and easily convert Portable Electric Drills into efficient Drill Presses. The operating handle has a 6 to 1 leverage which applies tremendous pressure to the work, and relieves the operator from the torque of the tool The bracket carrying the drill can be raised or lowered on the column, or swing in a circle A very useful accessory for Portable Electric Drills, Screw Drivers and Tappers

And Keep Them There

with

BLACK & DECKER PORTABLE ELECTRIC TOOLS



⅝" Electric Valve Refacer

A powerful, heavy duty precision Refacer—the result of years of experience in designing and manufacturing valve grinding equipment Two ball bearing motors, independently operated, of Universal type, using either A. C. or D. C. Capacity ⁵⁄₁₆" to ⅝". Will take care of practically all airplane engines in use today The revolving parts are so well balanced that the Refacer is practically vibrationless and is guaranteed accurate

Valve Seat Reamers

Realizing that aviation practice requires accuracy and speed in service operations, BLACK & DECKER have developed a new, fast-cutting Valve Seat Reamer This new reamer has inserted *tungsten steel teeth* of high temper, and will cut through the hardest glazed seats, leaving a mirror-like surface This reamer cuts labor time in half, at no sacrifice of accuracy or quality of work. When used with the Black & Decker Self Centering Pilot, extreme accuracy is assured because of centering cones at top and bottom of guide—the valve seat being cut concentric to the true running center of guide—assuring gas tight valve closure BLACK & DECKER Reamers have tapered holes and may be used with standard makes of pilots.

Aircraft Valve Reseating Sets

Black & Decker Aircraft Engine Valve Tools insure accurate reseating because of the self-centering pilot, which, with tapered cones at top and bottom, automatically finds the true running center of the guide The serrated tungsten steel cutters speedily reduce glazed, hardened seats to a smooth, true angle to match the refaced valve, making a gas-tight job The Universal set illustrated will service practically all makes of aircraft engines.

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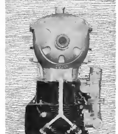
Upside Down Is Right Side Up!
LOUIS CHEVROLET

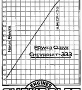
Famous for over two decades as a designer, builder and driver of commercial and racing motors, Louis Chevrolet now offers the aircraft industry a revolutionary advancement in aircraft engine design—the inverted, 4-in-line, air-cooled Chevrolet 333.



The HIGHEST BRAKE M. E. P.
of any Motor Ever Tested by the Bureau of Standards

RECORD BREAKING PERFORMANCE in recent Bureau of Standards tests is ample proof of the remarkable advance in aircraft engine design embodied in the new Chevrolet 333 (A. T. C. No. 59). The B. M. E. P. of this air-cooled inverted "4-in-line" motor is 136 lbs per square inch—the *highest* of any engine ever tested by the Bureau of Standards. Moreover, its weight per horse power —2.16 lbs—is the *lowest* of *any* engine below 200 H. P.! Its official rating is 120 H. P. at 2100 r. p. m. Weight, 260 lbs. when dry. Another noteworthy feature of the Chevrolet 333 is its low fuel consumption—.48 lbs. per B. H. P. Hr. at full horse power (official rating).

Note the unusual lines of this new motor. The advanced "upside down" construction permits greater visibility, higher propeller clearance and clean stream-lining. It results in greater dependability, too. Unusual cooling efficiency is secured by a combination of designs arrangements. The exhaust port directly below the head makes it possible to evenly cool the cylinders. Valves last longer and work better because all valve gear is kept in a constant bath of oil.



CHEVROLET ENGINES AIRCRAFT CORPORATION BALTIMORE, MARYLAND, U.S.A.

Furthermore, the pilot or mechanic has only *one* oiling job—putting oil in the oil tank! There are no rocker arms or push rods to oil and grease. No valve clearances to check and adjust. Care and maintenance of the engine are reduced to a minimum.

A dominant factor in the development of the Chevrolet 333 was the application of "Balanced Design." Each individual part was designed to do exactly its share of work perfectly. The result is remarkable performance with unusual smoothness and freedom from vibration.

Write for descriptive literature, giving further information and specifications. Chevrolet Aircraft Corporation, Baltimore, Md., U. S. A.

The New CHEVROLET-333
INVERTED 4-IN-LINE AIRCRAFT ENGINE

UNIVERSAL AVIATION CORPORATION
Division of The Aviation Corporation
CONTINENTAL AIR LINES, INC.
CLEVELAND AIRPORT
Cleveland, Ohio

July 10, 1930.

Mr. L. C. Walcott,
Aviation Department,
Packard Electric Company,
Warren, Ohio.

Dear Mr. Walcott:

Replying to your letter of July 8th concerning our experience with your #844 Lac-ard shield cable, we are pleased to advise as follows:

Shortly after the first of the year we made up a shielded ignition manifold assembly for a Wright J-5 motor on one of our radio equipped Stearman mail planes, C-6261. This plane is assigned to our Continental Division operating C.A.M. 16, Cleveland, Ohio to Louisville, Kentucky through Columbus, Springfield, Dayton and Cincinnati. About a month ago, when the motor was changed, the ignition manifold was found to be in such excellent condition that it was re-installed on the second motor. Checking both motor logs we find the total time of this harness to be 425 hours, twenty-five minutes, and the individual wires appear to be in original condition.

With regard to the shielding efficiency of this cable we might add that the plane is equipped with a Western Electric 9-A aircraft receiver and our pilots report consistent reception of the Department of Commerce radio stations at Cleveland and Bryan, Ohio as far down the line as Cincinnati and very often to Louisville, Ky.

Very truly yours,

M. W. Swanson,
Communications Engineer,
UNIVERSAL AVIATION CORPORATION

Packard Radio Shielded Ignition Cable No. 844
A New Development

1. Installed like ordinary cable
2. Complete elimination of interference
3. Low installation cost
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Write for complete information and samples

A Letter Like This Needs No Further Comment

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FOR the radial loads on the crankshaft, to sustain the propeller thrust and support the rocker arms, Lycoming have chosen SRB—because SRB with its maximum number of large balls, hot forged from molybdenum steel, gives the utmost in load carrying capacity and that dependability so necessary in aeronautical power plants.

That is why SRB Ball Bearings predominate in the aircraft engine field and are found in Wright, Curtiss, Pratt and Whitney, Warner, LeBlond, Velie and other well known engines.

Specify SRB, the aeronautical ball bearing for absolute dependability in your own equipment. Make sure that the ball bearing specification is worthy of the equipment you build. SRB engineers will be glad to cooperate with your engineering department.

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the real answer to safer landings and safer flying!

Between these two points you see the flag which goes on Goodyear products—and only Goodyear can give Airwheel safety.

Between these two points you also see the maximum distance between the hub and the ground — a distance which no mere "balloon tire" can give you — a distance made possible by the complete combination of the Goodyear Airwheel and Goodyear hub.

This distance is the reason that Airwheels can operate at pressures as low as five pounds—because it provides room for adequate air volume without high pressure in the tire.

This distance (and the low unit pressure it provides) enables airplanes to land on muddy fields and plowed ground with Airwheel safety. It accounts for the performance which has made Airwheels a success.

Since these great soft rolling rubber cushions were first announced, many questions have naturally been asked — and answered. Airwheels, beyond any doubt, are an important contribution to safer flying—and comments by leading designers and builders of airplanes, as well as prominent pilots, show that the Airwheel principle is here to stay.

If you have any questions about Airwheels — ask Goodyear. Then you will get the advantage of all the experience which has come out of pioneering, testing, developing and perfecting this new wheel and tire combined.

For information or engineering assistance in equipping your future ships, write Aeronautics Department, Goodyear, Akron, Ohio, or Los Angeles, California.

GOODYEAR

EVERYTHING IN RUBBER FOR THE AIRPLANE

Stout finds these Screws the only economical means of fastening interior trim

Of all the fastening methods available, only Hardened Self-tapping Sheet Metal Screws offered a practical and economical solution to the problem of fastening trim to the interior of Ford Tri-motor planes.

Nearly 2,000 fastenings are required to attach the panels, mouldings, sash and floors. *Yet this is an easy and speedy job* with Self-tapping Screws. One simple operation makes a secure fastening—a fastening that stands up even under severe vibration.

These unique Screws have solved many assembly problems in the aircraft industry. They have simplified design, speeded up production and materially reduced sheet metal assembly costs for nearly every builder of planes.

Send for a copy of the certified report of fastening methods followed in the plant of the Stout Metal Airplane Company. It contains much information of value to every design and production engineer.

Easier—Quicker—Cheaper sheet metal assemblies

Merely turn a Self-tapping Screw into a drilled or punched hole with a screw driver. The Screw taps its own thread in the metal and binds the sections firmly together.

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Sheet Metal Screws

Send for this interesting Survey

Unbiased engineers describe fastening methods used by Stout in assembling Ford Tri-motor planes.

ROBERTSON IS BLAZING TRAILS SOUTH WITH PAA

Just two years ago, at Miami, the Pan-American Airways erected its first hangar of Robertson Protected Metal (RPM) » » » Today there are hangars of RPM in San Salvador, at San Juan in Porto Rico, at Mexico City, at Vera Cruz and Cozumel in Mexico; at Puntarenas in Costa Rica; at Puerto Barrios in Guatemala; at Merida in Yucatan, and at Brownsville, Texas. » » » Almost half-a-million square feet of it . . . on roofs, on sidewalls » » » RPM is providing for the Pan-American the same qualities which have made it so universally used for hangar construction throughout the world. It has all the qualities which made unprotected metal so popular for early hangar construction . . . the lightness, the easy erection, the movability . . . and in addition, it has a permanence, a resistance to corrosion, a freedom from maintenance expense and a heat-insulating value that unprotected metal never had » » » Write for information about the use of RPM and other Robertson products in hangar construction. No obligation.

H. H. ROBERTSON COMPANY «» PITTSBURGH, PA.

ROBERTSON *shares its* HANGAR BUILDING *experience*

ROBERTSON WORLD WIDE BUILDING SERVICE

(Above) Two of the many Pan-American hangars built with RPM. These are at Brownsville, Texas.

The Robertson Company is in a position to assign engineering representatives to assist you in your hangar problems.

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UPHOLSTERY that strikes the keynote in luxury and comfort . . . genuine Angora mohair fabrics . . . the most regal and enduring of all textiles . . . that is Chase Velmo Upholstery.

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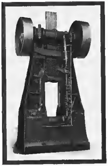
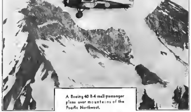


CHAMBERSBURG MODEL B BOARD DROP HAMMER



A Boeing 40 B-4 mail-passenger plane over mountains of the Pacific Northwest.

Another of the famous "40s"—on the job in the desert interior of Guatemala.

Enforce Safety at Your Airport with Cyclone Fence

The 5th Annual Air Tour last year proved that fencing is absolutely essential to the handling of crowds at airports. Many troubles were experienced at open airports. A magazine editor reporting the tour said "Crowds invaded the fields as soon as planes had landed. They milled heedlessly about while engines were being warmed up and the absence of fatalities can be accredited only to providential intervention."

But where airports are fenced, crowds are always out of danger, adding to the safety of both fliers and spectators.

Many leading airports have already installed Cyclone Fence. It is an invitation to air tours to visit their cities. It helps them become terminals for air lines. Interest in aviation is stimulated by absence of casualties.

Cyclone Fence is made of durable copper-steel and lasts for years in any climate. Special wide gates for airports. Erected on H-Column line posts for maximum strength. Installed by our own trained crews. Service everywhere.

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ALPHABETICAL INDEX

TO

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PROFESSIONAL SERVICES

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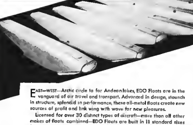

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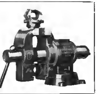

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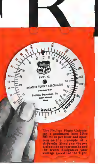

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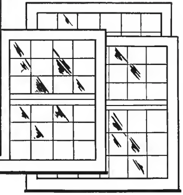

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